

Solutions Manual

For

Fundamentals of Corporate Finance

Third Edition

Global Edition

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Preface

This Solutions Manual contains the solutions to the end-of-chapter problems in Chapters 1–23 in the textbook.

Whether you are teaching the corporate finance course for the first time or are an experienced teacher at this level, we hope you will find this manual helpful.

The following features are available for download under the Solutions Manual listing on the Instructor's Resource Center online at www.pearsonhighered.com/irc:

Solutions to the Problems for Chapters 1–23: The solutions that appear in this printed Solutions Manual are provided.

Solutions to the Problems for Web Chapters 1–3: The solutions to the problems for these three Web chapters are provided.

Excel Solutions to the Problems for Chapters 1–23 and Web Chapters 1–3: The Excel instructor solutions and student templates that correlate to the problems in the textbook with an Excel icon are provided.

■ Additional Resources for Instructors

In addition to the Solutions Manual, the following supplements are available on the Instructor's Resource Center online at www.pearsonhighered.com/irc, unless otherwise noted:

- *Instructor's Manual:* The Instructor's Manual contains annotated chapter outlines, lecture launchers, and questions for further class discussion. It also contains the solutions to the Data Cases and Integrative Case problems, as well as answers to the chapter ending Critical Thinking questions in the book. As an additional resource to guide instructors with students who are planning to take the CFA exam, CFA learning outcomes met in each chapter are listed. A section also details how the end-of-chapter problems map to the accreditation standards set by the Association to Advance Collegiate Schools of Business (AACSB), so that instructors can track students' mastery of the AACSB standards.
- *MyFinanceLab®:* This fully integrated online homework system gives students the hands-on practice and tutorial help they need to learn finance efficiently. Ample opportunities for online practice and assessment in MyFinanceLab® (www.myfinancelab.com) are seamlessly integrated into each chapter and organized by section within the chapter summaries.
- *Videos:* Video clips available in MyFinanceLab® profile well-known firms such as Boeing and Intel through interviews and analysis. The videos focus on core topical areas such as capital budgeting and risk and return.
- *PowerPoint® Presentation:* The PowerPoint® Presentation includes figures and tables from the book along with additional examples of key concepts.

- *Test Bank*: The Test Bank provides a wealth of accuracy-verified testing material. Each chapter offers a wide variety of true/false, short answer, and multiple-choice questions.
- *Computerized Test Bank*: Every question in the Test Bank is also available in TestGen[®] software. This easy-to-use software is a valuable test preparation tool that allows professors to view, edit, and add questions.

Chapter 1

Corporate Finance and the Financial Manager

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. A corporation is a legal entity separate from its owners. This means ownership shares in the corporation can be freely traded. None of the other organizational forms share this characteristic.
2. Owners' liability is limited to the amount they invested in the firm. Stockholders are not responsible for any encumbrances of the firm; in particular, they cannot be required to pay back any debts incurred by the firm.
3. Corporations and limited liability companies. Limited partnerships provide limited liability for the limited partners, but not for the general partners.
4. Advantages: Limited liability, liquidity, infinite life
Disadvantages: Double taxation, separation of ownership and control
5. C corporations must pay corporate income taxes; S corporations do not pay corporate taxes but must pass on the income to shareholders to whom it is taxable. S corporations are also limited to 75 shareholders and cannot have corporate or foreign stockholders.
6. First, the corporation pays the taxes. After taxes, $\$2 \times (1 - 0.4) = \1.20 is left to pay dividends. Once the dividend is paid, personal tax on this must be paid leaving $\$1.20 \times (1 - 0.3) = \0.84 . So after all the taxes are paid, you are left with 84¢.
7. An S corporation does not pay corporate income tax. So it distributes \$2 to its stockholders. These stockholders must then pay personal income tax on the distribution. So they are left with $\$2 \times (1 - 0.3) = \1.40 .
8. The investment decision is the most important decision that a financial manager makes, as the manager must decide how to put the owners' money to its best use.
9. The goal of maximizing shareholder wealth is agreed upon by all shareholders because all shareholders are better off when this goal is achieved.

10. Shareholders can
 - a. Ensure that employees are paid with company stock and/or stock options.
 - b. Ensure that underperforming managers are fired.
 - c. Write contracts that ensure that the interests of the managers and shareholders are closely aligned.
 - d. Mount hostile takeovers.
11. When your parents pay for the meal, you benefit from the food but do not take on the cost of the food. This is similar to the agency problem in corporations, when managers can benefit from taking actions in their own personal interests using money that belongs to shareholders.
12. The agent (renter) will not take the same care of the apartment as the principal (owner) because the renter does not share in the costs of fixing damage to the apartment. To mitigate this problem, having the renter pay a deposit would motivate the renter to keep damages to a minimum. The deposit forces the renter to share in the costs of fixing any problems that are caused by the renter.
13. There is an ethical dilemma when the CEO of a firm has opposite incentives to those of the shareholders. In this case, you (as the CEO) have an incentive to potentially overpay for another company (which would be damaging to your shareholders) because your pay and prestige will improve.
14. The shares of a public corporation are traded on an exchange (or “over the counter” in an electronic trading system), while the shares of a private corporation are not traded on a public exchange.
15. A primary market is where the company sells shares of itself to investors. The secondary market is where investors can buy and/or sell the company’s shares with other investors (but not the company itself).
16. There are many differences to which one might point:
 - a. NYSE has a physical location, while NASDAQ is an OTC-computer-network.
 - b. NYSE is an auction market, whereas NASDAQ is a dealer market.
 - c. NYSE has a single market maker (the specialist) per stock, while NASDAQ has multiple competing market makers.
 - d. NYSE has more stringent listing standards than those of NASDAQ.
17. Investors always buy at the ask and sell at the bid. Because ask prices always exceed bid prices, investors “lose” this difference. It is one of the costs of transacting. Because the market makers take the other side of the trade, they make up this difference.
18. You would need to pay the ask price to buy Yahoo! That price is \$26.88 per share. If you sold, you would receive the bid price: \$26.85 per share.
19. The financial cycle describes how money flows from savers to companies and back. In the financial cycle, (1) people invest and save their money; (2) that money, through loans and stock, flows to companies who use it to fund growth through new products, generating profits and wages; and (3) the money then flows back to the savers and investors.

- 20.** Insurance companies essentially pool premiums together from policyholders and pay the claims of those who have an accident, fire, medical need, or die. This process spreads the financial risk of these events out across a large pool of policyholders and the investors in the insurance company. Similarly, mutual funds and pension funds take your savings and spread them out among the stocks and bonds of many different companies, limiting your risk exposure to any one company.
- 21.** Investment banking refers to the business of advising companies in major financial transactions. Examples include buying and selling companies or divisions, and raising new capital by issuing stock or bonds.
- 22.** Mutual, pension, and hedge funds all pool together money and invest it on behalf of the investors in the fund. They differ in terms of who the investors in the fund are and what the primary objective is. Mutual and pension funds are most similar except that pension funds are investing retirement savings invested through the workplace with the objective of providing retirement income for those employees. Hedge funds are only open to investments by wealthy individuals and endowments. They invest across all asset categories, usually seeking low-risk investment strategies that will generate high returns.

Chapter 2

Introduction to Financial Statement Analysis

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. In a firm's 10-K filing, four financial statements can be found: the balance sheet, the income statement, the statement of cash flows, and the statement of stockholders' equity. Financial statements in form 10-K are required to be audited by a neutral third party, who checks and ensures that the financial statements are prepared according to GAAP and that the information contained is reliable.
2. In the United States, the Financial Accounting Standards Board (FASB) establishes Generally Accepted Accounting Principles (GAAP) to provide a common set of rules and a standard format for public companies to use when they prepare their reports.
3. Each method will help find the same SEC filings. Yahoo! Finance also provides some analysis such as charts and key statistics.
4.
 - a. Long-term liabilities would decrease by \$200 million, and cash would decrease by the same amount. The book value of equity would be unchanged.
 - b. Inventory would decrease by \$50 million, as would the book value of equity.
 - c. Long-term assets would increase by \$100 million, cash would decrease by \$50 million, and long-term liabilities would increase by \$50 million. There would be no change to the book value of equity.
 - d. Accounts receivable would decrease by \$20 million, as would the book value of equity.
 - e. This event would not directly affect the balance sheet.
 - f. This event would not directly affect the balance sheet.
5. Global Conglomerate's book value of equity increased by \$1 million (\$22.2 million in 2013 – \$21.2 million in 2012) from 2012 to 2013. An increase in book value does not necessarily indicate an increase in Global's share price. The market value of a stock does not depend on the book value of equity, which is an accounting measure of historical performance, but on investors' expectation of the firm's future performance. There are many events that may affect Global's future profitability, and hence its share price, that do not show up on the balance sheet.
6.
 - a. \$3,807 million (cash & equivalents) and \$8,567 million (short-term investments/marketable securities) for a total of \$12,374 million
 - b. \$1,459 million
 - c. \$43,012 million
 - d. \$9,489 million, 0 (Qualcomm has no long-term debt)
 - e. \$33,523 million

7. a. At the end of September 2012, GMCR's had cash and cash equivalents of \$58.29 million.
 b. GMCR's total assets were \$3,615.79 million.
 c. GMCR's total liabilities were \$1,354.56 million, and it had \$531.53 million in total debt.
 d. The book value of GMCR's equity was \$2,261.23 million.

8. a. Revenues in 2012 were 3,859.20

$$\text{Increase in Revenues} = \frac{3,859.2}{2,650.9} - 1 = 45.58\%$$

b. Operating Margin (2011) = $\frac{368.91}{2,650.90} = 13.92\%$

Operating Margin (2012) = $\frac{568.90}{3,859.20} = 14.74\%$

Net Profit Margin (2011) = $\frac{199.50}{2,650.90} = 7.53\%$

Net Profit Margin (2012) = $\frac{362.63}{3,859.20} = 9.40\%$

Both margins increased compared with the year before.

- c. The diluted earnings per share in 2012 were \$2.28. The number of shares used in this calculation of diluted EPS was 159.08 million.



9. See Table 2.5 showing financial statement data and stock price data for Mydeco Corp.

- a. By what percentage did Mydeco's revenues grow each year from 2010 to 2013?
 b. By what percentage did net income grow each year?
 c. Why might the growth rates of revenues and net income differ?

Year	2009	2010	2011	2012	2013
Revenue	404.3	363.8	424.6	510.7	604.1
Revenue growth		-10.02%	16.71%	20.28%	18.29%

Year	2009	2010	2011	2012	2013
Net Income	18.0	3.0	6.3	12.7	21.7
Net Income growth		-83.33%	110.00%	101.59%	70.87%

- c. Net Income growth rate differs from revenue growth rate because cost of goods sold and other expenses can move at different rates than revenues. For example, revenues declined in 2010 by 10%; however, cost of goods sold only declined by 7%.



10. See Table 2.5 showing financial statement data and stock price data for Mydeco Corp. Suppose Mydeco repurchases 2 million shares each year from 2010 to 2013. What would its earnings per share be in 2013?

A repurchase does not impact earnings directly, so any change to EPS will come from a reduction in shares outstanding. 2013 shares outstanding = $55 - 4 \times 2 = 47$ million, EPS

$$= \frac{21.7}{47} = \$0.46$$



- 11. See Table 2.5 showing financial statement data and stock price data for Mydeco Corp. Suppose Mydeco had purchased additional equipment for \$12 million at the end of 2010, and this equipment was depreciated by \$4 million per year in 2011, 2012, and 2013. Given Mydeco's tax rate of 35%, what impact would this additional purchase have had on Mydeco's net income in years 2010–2013?**

The equipment purchase does not impact net income directly; however, the increased depreciation expense and tax savings changes net income.

Year	2010	2011	2012	2013
Net Income	3.0	6.3	12.7	21.7
Additional Depreciation		-4.0	-4.0	-4.0
Tax Savings		1.4	1.4	1.4
New Net Income	3.0	3.7	10.1	19.1



- 12. See Table 2.5 showing financial statement data and stock price data for Mydeco Corp. Suppose Mydeco's costs and expenses had been the same fraction of revenues in 2010–2013 as they were in 2009. What would Mydeco's EPS have been each year in this case?**

If Mydeco's costs and expenses had been the same fraction of revenues in 2010–2013 as they were in 2009, then their net profit margins would have been equal.

$$\text{2009 net profit margin} = \frac{18}{404.3} = 4.45\%.$$

Year	2009	2010	2011	2012	2013
Revenue	404.3	363.8	424.6	510.7	604.1
Net Profit Margin	4.45%	4.45%	4.45%	4.45%	4.45%
New Net Income	18.0	16.2	18.9	22.7	26.9
Shares Outstanding	55.0	55.0	55.0	55.0	55.0
New EPS	\$0.33	\$0.29	\$0.34	\$0.41	\$0.49

- 13. a.** A \$5 million operating expense would be immediately expensed, increasing operating expenses by \$5 million. This would lead to a reduction in taxes of $40\% \times \$5 \text{ million} = \2 million . Thus, earnings would decline by $5 - 2 = \$3 \text{ million}$. There would be no effect on next year's earnings.
- b.** Capital expenses do not affect earnings directly. However, the depreciation of \$1 million would appear each year as an operating expense. With a reduction in taxes of $1 \times 40\% = \$0.4 \text{ million}$, earnings would be lower by $1 - 0.4 = \$0.6 \text{ million}$ for each of the next 7 years.
- *14. Plan:** Quisco Systems wishes to acquire a new networking technology and is confronted with a common business problem: whether to develop the technology itself in-house or to acquire another company that already has the technology. Quisco must perform a comprehensive analysis of each option, not just comparing internal development costs versus acquisition costs, but considering tax implications as well.

Execute:

- a.** If Quisco develops the product in-house, its earnings would fall by $\$500 \times (1 - 35\%) = \325 million . With no change to the number of shares outstanding, its EPS would decrease by $\$0.05 = \$325/6500$ to \$0.75. (Assume the new product would not change this year's revenues.)

- b. If Quisco acquires the technology for \$900 million worth of its stock, it will issue $\$900/18 = 50$ million new shares. Because earnings without this transaction are $\$0.80 \times 6.5 \text{ billion} = \5.2 billion , its EPS with the purchase is $5.2/6.55 = \$0.794$.

Evaluate: Acquiring the technology would have a smaller impact on earnings. But this method is not cheaper. Developing it in-house is less costly and provides an immediate tax benefit. The earnings impact is not a good measure of the expense. In addition, note that because the acquisition permanently increases the number of shares outstanding, it will reduce Quisco's earnings per share in future years as well.

15. a. Net cash provided by operating activities was \$482.94 million in 2012.
 b. Depreciation expense was \$135.66 million in 2012.
 c. Net cash used in new property and equipment was \$401.12 million – \$135.48 million = \$265.64 million in 2012.
 d. GMCR raised \$12.092 million from sale of shares of its stock (under compensation plans), while it spent \$76.47 million on the repurchase of common stock. GMCR raised –\$64.378 million from the sale of its shares of stock (net of any purchases).



16. a. The company's cumulative earnings over these four quarters were \$918.268 million. Its cumulative cash flows from operating activities were \$1.186 billion.
 b. Fraction of cash from operating activities used for investment over the four quarters:

	4	3	2	1	4 Quarters
Operating Activities	227,502	–13,935	717,635	254,534	1,185,736
Investing Activities	–196,952	–35,437	–251,331	–96,848	–580,568
CFI/CFO	86.57%	–254.30%	35.02%	38.05%	48.96%

- c. Fraction of cash from operating activities used for financing over the four quarters:

	4	3	2	1	4 Quarters
Operating Activities	227,502	–13,935	717,635	254,534	1,185,736
Financing Activities	462,718	–13,357	–526,189	–96,044	–172,872
CFF/CFO	–203.39%	–95.85%	73.32%	37.73%	14.58%

17. **Plan:** Even a relatively simple transaction such as receiving an order to sell merchandise on credit and shipping the order promptly creates a series of changes within the firm. Map out the changes that would occur to a firm that engages in a relatively simple business transaction.

Execute:

- a. *Revenues*: increase by \$5 million
 b. *Earnings*: increase by \$3 million
 c. *Receivables*: increase by \$4 million
 d. *Inventory*: decrease by \$2 million
 e. *Cash*: increase by \$3 million (earnings) – \$4 million (receivables) + \$2 million (inventory) = \$1 million (cash)

Evaluate: We can see that even a relatively simple credit sale has impacts on Revenues, Earnings, Accounts Receivable, Inventory, and eventually Cash.

- 18. Plan:** Nokela Industries plans to purchase a capital asset. In this case it is a \$40 million cyclo-converter. Any time a firm acquires a capital asset, it is permitted to depreciate the asset for tax purposes. This has Depreciation Expense, Tax Expense, and Cash Flow effects that must be understood and analyzed.

Execute:

- Earnings for the next four years would have to deduct the depreciation expense. After taxes, this would lead to a decline of $10 \times (1 - 40\%) = \$6$ million each year for the next four years.
- Cash flow for the next four years: less \$36 million ($-6 + 10 - 40$) this year, and add \$4 million ($-6 + 10$) for the three following years.

Evaluate: For the next four years, the investment in the cyclo-converter will increase Nokela's depreciation expense by \$10 million and will reduce after-tax earnings by \$6 million per year. Depreciation expense is a non-cash expense (it is an accrual that recognizes that the value of the asset, which has already been paid for, is declining in value) that the firm does not have to pay out. Because every dollar of depreciation expense lowers Nokela's taxable income by a dollar, its tax savings therefore are 40 cents on the dollar. The \$10 million in depreciation expense in the next four years will lower Nokela's tax bill by \$4 million ($\$10 \text{ million} \times 0.4$) per year.

- 19. Plan:** The problem presents us with some raw financial information for General Electric. While useful, this raw financial information is not well suited to support financial analysis of General Electric and to answer such questions as: How has the stock market valued GE? How much debt does GE use relative to the equity financing that GE uses? How valuable, in today's dollars, is GE?

To answer these and other questions we must compute key ratios and current market values as opposed to historical cost values.

Execute:

- Market capitalization = $10.3 \text{ billion} \times \$23 = \$236.9 \text{ billion}$

$$\text{Market-to-book ratio} = \frac{236.9}{123} = 1.93$$

- Book debt-equity ratio = $\frac{397}{123} = 3.23$

$$\text{Market debt-equity ratio} = \frac{397}{236.9} = 1.68$$

- Enterprise value = $236.9 + 397 - 90 = 543.9 \text{ (billion)}$

Evaluate: GE has a market-to-book ratio of 1.93. Over time, equity investors invested \$123B in GE; today that equity investment is worth \$236.9B (or 1.93 times more). This indicates that GE's management has run the firm well, and equity investors expect strong results in the future.

GE has a book debt-equity ratio of 3.23. Over time, equity investors invested \$123B in GE and debt investors invested \$397B (or 3.23 times more). This would indicate that GE is very heavily financed with debt. But remember these are book values. In part (a) above, we calculated that GE's equity is valued at \$236.9B in today's dollars. The market d-e ratio provides a very different picture.

GE has an enterprise value of \$543.9B. In today's dollars, investors value the entire company at this value.

20. a. Apple's current ratio $= \frac{63.34}{35.51} = 1.78$
- b. Apple's quick ratio $= \frac{63.34 - 1.25}{35.51} = 1.75$
- c. Apple's higher current and quick ratios demonstrate that it has higher asset liquidity than does Dell. This means that in a pinch, Apple has more liquidity to draw on than does Dell.
21. **Plan:** The table presents raw data about ANF and GPS. While useful, this information does not easily tell us how the stock market values each of these firms alone and by comparison. To accomplish this, we will compute the market-to-book ratio of each firm and then compare them.

Execute:

- a. ANF's market-to-book ratio $= \frac{35.48 \times 82.55}{1,693} = 1.73$
- GPS's market-to-book ratio $= \frac{27.90 \times 489.22}{3,017} = 4.52$
- b. The market looks more favorably on the outlook of The Gap than on Abercrombie & Fitch.

Evaluate: The market values, in a relative sense, the outlook of The Gap more favorably than Abercrombie & Fitch. For every dollar of equity invested in GPS, the market values that dollar today at \$4.52 versus \$1.73 for a dollar invested in ANF. Equity investors are willing to pay relatively more today for shares of GPS than for ANF because they expect GPS to produce superior performance in the future.

22. **In fiscal year 2011, Starbucks Corporation (SBUX) had revenue of \$11.70 billion, gross profit of \$6.75 billion, and net income of \$1.25 billion. Peet's Coffee and Tea (PEET) had revenue of \$372 million, gross profit of \$72.7 million, and net income of \$17.8 million.**

- a. Compare the gross margins for Starbucks and Peet's.
- b. Compare the net profit margins for Starbucks and Peet's.
- c. Which firm was more profitable in 2011?

- a. Starbucks' gross margin $= \frac{6.75}{11.70} = 57.69\%$; Peet's gross margin $= \frac{72.7}{372} = 19.54\%$.
- b. Starbucks' net margin $= \frac{1.25}{11.70} = 10.68\%$; Peet's net margin $= \frac{17.8}{372} = 4.78\%$.
- c. Starbucks was more profitable in 2011.

23. **Plan:** We can use Eqs. 2.9, 2.10, and 2.11 to compute Local's margins. The problem gives us the necessary inputs.

Execute:

- a. Gross Margin $= \frac{\text{Gross Profit}}{\text{Sales}} = \frac{12 - 5}{12} = 58.33\%$
- b. Operating Margin $= \frac{\text{Operating Income}}{\text{Sales}} = \frac{12 - 5 - 0.85 - 1.5 - 1.2}{12} = 28.75\%$

$$\text{c. Net Profit Margin} = \frac{\text{Net Income}}{\text{Sales}} = \frac{(12 - 5 - 0.85 - 1.5 - 1.2)(1 - 0.4)}{12} = 17.25\%$$

Evaluate: Local is profitable. You can see how the margins decrease as you move down the income statement because each successive margin takes into account more costs.

- 24. Plan:** Selling expenses do not affect the gross margin, but the increase in such expenses will decrease the other margins.

Execute:

Gross margin would not change.

$$\text{Operating Margin} = \frac{\text{Operating Income}}{\text{Sales}} = \frac{12 - 5 - 1.35 - 1.5 - 1.2}{12} = 24.58\%$$

$$\text{Net Profit Margin} = \frac{\text{Net Income}}{\text{Sales}} = \frac{(12 - 5 - 1.35 - 1.5 - 1.2)(1 - 0.4)}{12} = 14.75\%$$

Evaluate: Gross margin only accounts for cost of good sold. The effect of the additional selling expenses can be seen in the reduced operating and net profit margins.

- 25. Plan:** Only the net profit margin accounts for interest expense, so both the gross and operating margins will be unaffected.

Execute:

Gross margin would not change.

Operating margin would not change.

$$\text{Net Profit Margin} = \frac{\text{Net Income}}{\text{Sales}} = \frac{(10 - 6 - 0.5 - 1 - 1 - 0.8)(1 - 0.35)}{10} = .0455, \text{ or } 4.55\%$$

Evaluate: If you were focused only on the gross and operating margins, you would not see the impact of the increased interest expense, which shows-up in the net profit margin.

- 26.** Using operating income as a multiple of interest to compute interest coverage, we have:
operating income = $0.15 \times \$50 \text{ million} = \7.5 million , so its interest coverage is $\$7.5 \text{ million} / \$1.8 \text{ million} = 4.17 \text{ times}$.

- 27. Plan:** First, we must compute Ladders' net income using the fact that net profit margin is net income/sales. Then we can compute the ROE as net income/book equity and the ROA as net income/book assets.

Execute:


First, Ladders' net income: $0.08 \times \$70 \text{ million} = \5.6 million .

ROE = Net Income/Book Equity = $\$5.6 \text{ million} / \$50 \text{ million} = 11.2\%$

ROA = Net Income/Book Assets = $\$5.6 \text{ million} / (\$40 \text{ million} + \$50 \text{ million}) = 6.22\%$

Evaluate: ROE measure the net income (to shareholders) as a percentage of the book value of their investment. ROA measures the net income (to shareholders) as a percentage of the book value of all the assets used to generate the income. A firm with positive book equity and some

debt will always have a lower ROA than ROE. ROA and ROE will be the same for a firm with no liabilities.

-  **28. Plan:** Using the information provided and Eqs. 2.15 to 2.18, we can compute all the efficiency ratios for JPJ.

Execute:


$$\text{Accounts Receivable Days} = \frac{\text{Accounts Receivable}}{\text{Average Daily Sales}} = \frac{50,000}{(1,000,000 / 365)} = 18.25$$

$$\text{Fixed Asset Turnover} = \frac{\text{Sales}}{\text{Fixed Assets}} = \frac{1,000,000}{3,000,000} = 0.333$$

$$(\text{Total}) \text{ Asset Turnover} = \frac{\text{Sales}}{\text{Total Assets}} = \frac{1,000,000}{5,000,000} = 0.2$$

$$\text{Inventory Turnover} = \frac{\text{Cost of Goods Sold}}{\text{Inventory}} = \frac{600,000}{150,000} = 4$$

Evaluate: These ratios allow you to evaluate how efficiently JPJ is utilizing its assets and how quickly it is collecting its accounts receivables.

-  **29. Plan:** : Using the 10% growth rate, we can compute the new sales number and then the 5% growth rate will give us the new assets number. We can then recompute the asset turnover ratios.

Execute:

$$\text{Sales} = 6,000,000(1.12) = 6,720,000$$


$$\text{Assets} = 25,000,000(1.08) = 27,000,000$$

$$\text{Fixed assets} = 18,000,000(1.08) = 19,440,000$$

$$\text{Fixed Asset Turnover} = \frac{\text{Sales}}{\text{Fixed Assets}} = \frac{6,720,000}{19,440,000} = 0.35$$

$$(\text{Total}) \text{ Asset Turnover} = \frac{\text{Sales}}{\text{Total Assets}} = \frac{6,000,000}{27,000,000} = 0.22$$

Evaluate: Because sales are growing faster than assets, we see that efficiency of asset utilization is increasing—the turnover ratios are higher.

-  ***30. Plan:** We are given some data about Global's financial results in 2013. Global launched a marketing campaign that increased sales but also decreased operating margins. We must calculate the effects of these changes on revenues, net income, and stock price.

Execute:

- Revenues in 2013 = $1.15 \times 186.7 = \$214.705$ million
EBIT in 2013 = $4.50\% \times 214.705 = \9.66 million (there is no other income)
- Net income in 2013 = EBIT – interest expenses – taxes
= $(9.66 - 7.7) \times (1 - 24\%)$
= \$1.49 million

$$c. \text{ Share price} = (\text{old P/E ratio in 2013}) \times (\text{new EPS in 2013}) = 18 \times \left(\frac{1.45}{3.6} \right) = \$7.25$$

Evaluate: The new aggressive marketing campaign succeeded in raising revenues by 15%. Unfortunately, operating margins fell from 5.57% to 4.50%, which reduced EBIT and net income. As a result, the stock price fell from \$10 to \$7.25. The new marketing campaign destroyed stockholder value and is therefore a failure.



31. Plan: The table presents raw data about Debt, Equity, Operating Income, and Interest Expense. While useful, this information does not easily tell us how much financial leverage each of these firms alone and by comparison is using. It also does not tell us how well each firm is able to support its debt. To accomplish this, we will compute various leverage ratios of each firm and then compare them.

Execute:

$$a. \text{ Firm A: Market debt-equity ratio} = \frac{500}{400} = 1.25$$

$$\text{Firm B: Market debt-equity ratio} = \frac{80}{40} = 2.00$$

$$b. \text{ Firm A: Book debt-equity ratio} = \frac{500}{300} = 1.67$$

$$\text{Firm B: Book debt-equity ratio} = \frac{80}{35} = 2.29$$

$$c. \text{ Firm A: Interest coverage ratio} = \frac{100}{50} = 2.00$$

$$\text{Firm B: Interest coverage ratio} = \frac{8}{7} = 1.14$$

Evaluate: Firm B has a lower coverage ratio and will have slightly more difficulty meeting its debt obligations than Firm A.



32. Plan: The table presents raw data about Sales, Accounts Receivable, and Inventory data for Walmart and Target. While useful, this information does not tell us easily how well each firm is managing its Accounts Receivable and Inventory in general and in comparison with each other. To accomplish this, we will compute the relevant ratios of each firm and then compare them.

Execute:

$$a. \text{ Walmart: Accounts Receivable Days} = \frac{6,768}{\left(\frac{469,162}{365} \right)} = 5.27$$

$$\text{Target: Accounts Receivable Days} = \frac{6,857}{\left(\frac{73,301}{365} \right)} = 34.14$$

$$b. \text{ Walmart: Inventory Turnover} = \frac{352,488}{43,803} = 8.05$$

$$\text{Target: Inventory Turnover} = \frac{50,568}{7,903} = 6.40$$

- c. Walmart is managing its accounts receivable and inventory more efficiently, as shown by the above ratios (shorter AR days and more AR turnover).

Evaluate: Walmart is managing its accounts receivable and inventory more efficiently, as shown by the above ratios. Walmart collects its accounts receivable in 5.27 days as opposed to 34.14 days for Target. Likewise Walmart turns over its inventory 8.05 times a year, as opposed to 6.40 times for Target.

- 33. Plan:** Use the DuPont Identity to perform the analysis:
Net Profit Margin \times Total Asset Turnover \times Total Assets/Equity

Execute:

- a. $5.5\% \times 2.4 \times 53/25 = 27.98\%$
b. $6\% \times 2.4 \times 53/25 = 30.53\%$
c. $6\% \times (2.4 \times 1.25) \times 53/25 = 38.16\%$

Evaluate: The analysis demonstrates different ways that a company can increase its overall ROE—by increasing its net profit margin or its asset turnover.

- 34. Plan:** Use the DuPont Identity to perform the analysis:
Net Profit Margin \times Total Asset Turnover \times Total Assets/Equity

Execute:

- a. $3.5\% \times 1.8 \times 44/18 = 15.4\%$
b. $4\% \times 1.8 \times 44/18 = 17.6\%$
c. $4\% \times (1.8 \times 1.2) \times 44/18 = 21.1\%$

Evaluate: The analysis demonstrates different ways that a company can increase its overall ROE—by increasing its net profit margin or its asset turnover.

- 35. a.** $\text{GMCR's Net Profit Margin} = \frac{362.63}{3,859.20} = 9.40\%$

$$\text{GMCR's Asset Turnover} = \frac{3,859.20}{3,615.79} = 1.07$$

$$\text{GMCR's Equity Multiplier} = \frac{3,615.79}{2,261.23} = 1.60$$

- b. $\text{GMCR's ROE (DuPont)} = 9.40\% \times 1.07 \times 1.60 = 16.09\%$
c. $\text{GMCR's revised ROE} = 9.40\% \times 1.1363 \times 1.60 = 17.09\%$.
GMCR's would need to increase asset turnover to more than 1.136 times.

- 36.** $\text{Net Profit Margin} = \frac{1,383.8}{13,299.5} = 10.4\%$

$$\text{Asset Turnover} = \frac{13,299.5}{8,219.2} = 1.62$$

$$\text{Asset Multiplier} = \frac{8,219.2}{5,109.0} = 1.61$$

Starbucks's ROE (DuPont) = $10.4\% \times 1.62 \times 1.61 = 27.09\%$

The two firms' ROEs differ mainly because Starbucks has a higher asset turnover and profit margin. (Their asset multipliers, a measure of leverage, are essentially the same.)



- 37. Plan:** You are presented with a large amount of financial information over several years about a company. You are asked to analyze this information around issues of profitability and book and market values of equity for your boss.

Execute:

- a. The book value of the equity decreased by \$2.101 billion compared to that at the end of the previous quarter and was negative.
- b. Because the book value of equity is negative in this case, the company's market-to-book ratio and its book debt-equity ratio are not meaningful. Its market debt-equity ratio may be used in comparison.
- c. Information from the statement of cash flows helped explain that the decrease of book value of equity resulted from an increase in debt that was used to repurchase \$2.110 billion worth of the firm's shares.
- d. Negative book value of equity does not necessarily mean the firm is unprofitable. Loss in gross profit is only one possible cause. If a firm borrows to repurchase shares or invest in intangible assets (such as R&D), it can have a negative book value of equity.

Evaluate: The company issued debt to buy back \$2.11 billion in equity. Obviously, that resulted in a large increase in outstanding debt and a large decline in outstanding equity. This resulted in the book value of the company's equity being negative. On the surface, a negative book value of equity would suggest an unprofitable if not failed firm. The reality in this case is much more complicated.

- 38.**
- a. PricewaterhouseCoopers LLP certified Peet's financial statements.
 - b. The CEO, Brian P. Kelley, and the CFO, Frances G. Rathke certified GMCR's financial statements.

Chapter 3

Time Value of Money: An Introduction

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** The benefit of the rebate is that Honda will sell more vehicles and earn a profit on each additional vehicle sold:

Benefit = Profit of \$6,000 per vehicle \times 15,000 additional vehicles sold = \$90 million.

Execute: The cost of the rebate is that Honda will make less on the vehicles it would have sold:

$$\begin{aligned}\text{Cost} &= \text{Loss of \$2000 per vehicle} \\ &\quad \times 40,000 \text{ vehicles that would have sold without rebate} \\ &= \$80 \text{ million.}\end{aligned}$$

Evaluate: Thus, Benefit – Cost = \$90 million – \$80 million = \$10 million, and offering the rebate looks attractive.

(Alternatively, we could view it in terms of total, rather than incremental, profits. The benefit is \$6000/vehicle \times 55,000 sold = \$330 million, and the cost is \$8000/vehicle \times 40,000 sold = \$320 million.)

2. **Plan:** If the shrimp from your Czech and Thai suppliers are of equal quality, you will buy the shrimp from the supplier who offers you the lowest price. One problem is the Czech supplier quotes you a price in koruna and the Thai supplier quotes you a price in baht. Because you will have to convert dollars to either koruna or baht, you will buy the shrimp from the supplier who will charge you the lowest cost in dollars.

Execute: Czech buyer's offer in dollars = 2,000,000 CZK/(25.50 CZK/USD) = 78,431.37 USD. Thai supplier's offer in dollars = 3,000,000 THB/(41.25 THB/USD) = 72,727.27 USD.

Evaluate: You would buy the shrimp from the Thai supplier because the Thai shrimp are (\$78,431 – \$72,727), \$5,704 less expensive today.

- 3. Plan:** There are two related, but different, decisions to analyze. In both cases you will take the choice that will give you the highest value.

Execute:

- a. Value of the stock bonus today = $100 \times \$63 = \$6,300$
Value of the cash bonus today = \$5,000
Because you can sell the stock for \$6,300 in cash today, its value is \$6,300, which is better than the cash bonus of \$5,000 today. Take the stock.
- b. Because you could buy the stock today for \$6,300 if you wanted to, the value of the stock bonus cannot be more than \$6,300. But if you are not allowed to sell the company's stock for the next year, its value to you could be less than \$6,300. Its value will depend on what you expect the stock to be worth in one year, as well as how you feel about the risk involved. There is no clear-cut answer to which alternative is best because taking the stock today and holding it for a year involves risk. You might decide that it is better to take the \$5,000 in cash than to wait for the uncertain value of the stock in one year. This would be especially true if you believed you could invest the \$5,000 today in another asset that would be worth more than \$6,300 in one year.

Evaluate: In part (a) there is a clear-cut answer. Take the stock today because it is worth more than the cash bonus. In part (b) there is not a clear-cut answer because you cannot directly compare \$5,000 cash today against the uncertain value of 100 shares of stock in one year. Different people could make different decisions based largely on their estimate of the future value of the stock.

- 4. Plan:** With two different interest rates for the same thing (borrowing or saving), you can make a sure profit by borrowing at the lower rate and depositing the money at the higher rate.
- a. Take a loan from Big Bank at 5.5% and save the money in Bank Enn at 6%.
- b. Big Bank would experience a surge in the demand for loans, while Bank Enn would receive a surge in deposits.
- c. Big Bank would increase the interest rate, and/or Bank Enn would decrease its rate.

Evaluate:

Your actions along with those of others would create a surge in demand for loans at the low rate and deposits at the high rate, causing the banks to change the rates until they are equal—the arbitrage opportunity would quickly disappear.

- 5.** Apple cannot charge more than the cost of doing it yourself, so the maximum is \$25, the same as the cost of buying the CD and ripping the tracks to your iPod.
- 6. Plan:** The same share of stock cannot trade for two different prices—otherwise there would be an arbitrage opportunity (you would buy it on the exchange with the lower price and immediately sell it on the exchange with the higher price). Thus, the U.S. price must be the Canadian price multiplied by the exchange rate.

$$\text{RIM}_{\text{US}} = \$50 \text{ Canadian} \times \left(\frac{\text{US } \$0.95}{\text{C } \$1.00} \right) = \text{US } \$47.50$$

Evaluate: If the price were any different, there would be an arbitrage opportunity as described in the plan statement and a flood of buy and sell orders would force the prices to be equal.

7. **Plan:** Determine the value of 1 ton of shrimp to Bubba, and determine the change in value to Bubba of 1 ton of shrimp because of his allergy.

Execute:

- The value of 1 ton of shrimp to Bubba is \$10,000 because that is the market price.
- No. As long as he can buy or sell shrimp at \$10,000 per ton, his personal preference or use for shrimp is irrelevant to the value of the shrimp.

Evaluate: In well-functioning markets, the price, and therefore the value, is set by the supply and demand of all suppliers and users.

8. **Plan:** Brett must determine if he should accept his neighbor's offer to trade his almond crop for the neighbor's walnut crop. He should calculate the value of keeping his almond crop versus the value of trading for the walnut crop. Brett should take the alternative that makes him the best off financially. Brett must also determine if his preference for walnuts over almonds should influence his decision.

Execute:

- Brett calculates the market value of the almond crop is \$100,000 (1,000 tons at @ \$100 per ton), while the market value of the walnut crop is \$88,000 (800 tons @ \$110 per ton).

Evaluate: No, he should not make the exchange. He would not give up an asset worth \$100,000 for an asset worth \$88,000.

9. **Plan:** You need to compute the future value (FV) based on an 8% interest rate and a present value (PV) of \$500. 8% interest rate means for every \$1 today, you get \$1.08 in a year.

Execute:

$$FV = \$500 \text{ today} \times \left(\frac{\$1.08 \text{ in one year}}{\$ \text{ today}} \right) = \$540 \text{ in one year}$$

Evaluate: \$500 today and \$540 in one year have equivalent values to you because with \$500 today, you could deposit it and have \$540 in one year.

10. **Plan:** You need to compute the PV of \$1,100 (a Future Value) based on a 10% discount rate, meaning every \$1.10 in one year is worth only \$1 today.

Execute:

$$PV = \$1,100 \text{ in one year} \div \left(\frac{\$1.1 \text{ in one year}}{\$ \text{ today}} \right) = \$1,000 \text{ today}$$

Evaluate: If you expect to have \$1,100 in one year, you could borrow \$1,000 today and in one year you would have exactly enough to pay off the loan with 10% interest.

11. **Plan:** You are presented with three alternative courses of action. You could deposit the \$55 you have today. You could lend the \$55 you have today to your friend and use your friend's

promised payment of \$58 in one year as collateral for a loan and get cash today. Or, you could loan the money to your friend today or deposit it in the bank. You should select the alternative that makes you the best off financially.

Execute: If you deposit the money in the bank today, you will have:

$$FV = \$55 \text{ today} \times \left(\frac{\$1.06 \text{ in one year}}{\$ \text{ today}} \right) = \$58.30 \text{ in one year}$$

If you lend the money to your friend for one year and borrow against the promised \$58 repayment, then you could borrow:

$$PV = \$58 \text{ in one year} \div \left(\frac{\$1.06 \text{ in one year}}{\$ \text{ today}} \right) = \$54.72 \text{ today}$$

Evaluate: From a financial perspective, you should deposit the money in the bank, as it will result in more money for you at the end of the year.

12. From your perspective:

Today	1 year
+	+
1000	1080

From the bank's perspective:

Today	1 year
+	+
1000	1080

13. You get the TV and have to pay \$1,000 in one year. The discount rate is 4%:

$$PV = \frac{\$1000}{(1.04)} = \$961.54$$

14. **Plan:** You are considering three related questions. As usual, you will select the alternative that makes you the financially best off (wealthiest).

Execute:

- Having \$200 today is equivalent to having $200 \times 1.04 = \$208$ in one year.
- Having \$200 in one year is equivalent to having $200/1.04 = \$192.31$ today.

Evaluate: Because money today is worth more than money in the future, \$200 today is preferred to \$200 in one year. This answer is correct even if you do not need the money today because, by investing the \$200 you receive today at the current interest rate, you will have more than \$200 in one year.

15. $FV = \$100, n = 10, r = 0.02$

$$PV = \frac{\$100}{(1.02)^{10}} = \$82.03$$

16. $FV = \$100, n = 10, r = 0.02$

$$PV = \frac{\$100}{(1.02)^{10}} = \$82.03$$

17. **Plan:** The only way to compare all of these options is to put them on equal footing: present value.

Execute:

- a. Option ii > Option iii > Option i

$$PV_i = \frac{100}{(1.10)^1} = 90.91$$

$$PV_{ii} = \frac{200}{(1.10)^5} = 124.18$$

$$PV_{iii} = \frac{300}{(1.10)^{10}} = 115.66$$

- b. Option iii > Option ii > Option i

$$PV_i = \frac{100}{(1.05)^1} = 95.24$$

$$PV_{ii} = \frac{200}{(1.05)^5} = 156.71$$

$$PV_{iii} = \frac{300}{(1.05)^{10}} = 184.17$$

- c. Option i > Option ii > Option iii

$$PV_i = \frac{100}{(1.20)^1} = 83.33$$

$$PV_{ii} = \frac{200}{(1.20)^5} = 80.38$$

$$PV_{iii} = \frac{300}{(1.20)^{10}} = 48.45$$

Evaluate:

Lower discount rates make distant cash flows more valuable, so when the discount rate is only 5%, option 3, with the longest time until receiving the cash flow, is the most valuable. However, when the discount rate is 20%, option 3 is the least valuable.

- *18. Plan:** You must first compute the FV and then subtract off the initial investment and the simple interest, which is simply 9% of \$25,000 per year (\$2,250).

Execute:

- a. $FV = 25,000(1.09)^5 = 38,465.60$, simple interest is 9% (\$2,250) per year $\times 5 = \$11,250$ and initial investment is \$25,000, so interest on interest is $\$38,465.60 - \$25,000 - \$11,250 = \$2,215.60$
- b. $FV = 25,000(1.09)^{25} = 215,577.02$, simple interest is $25 \times \$2,250 = \$56,250$ and initial investment is \$25,000, so interest on interest is $\$215,577.02 - \$56,250 - \$25,000 = \$134,327.02$

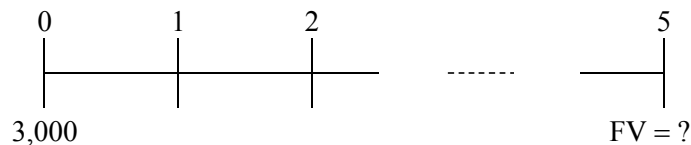
Evaluate:

As time progresses, the interest on interest becomes increasingly important, dwarfing the simple interest (which represents the interest on your initial investment).

- 19. Plan:** Determine the future values of the different interest rates and the different time periods. Compare the differences in future values.

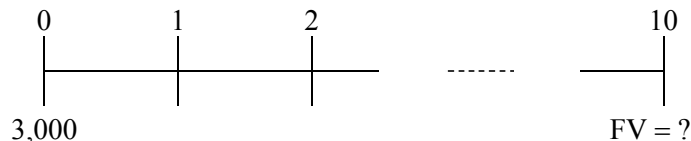
Execute:

- a. $FV_5 = 3,000 \times 1.08^5$
 $= 4,407.98$



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5	8.00%	3000.00	0		
Solve for FV:					(\$4407.98)	=FV(0.08,5,0,3000)

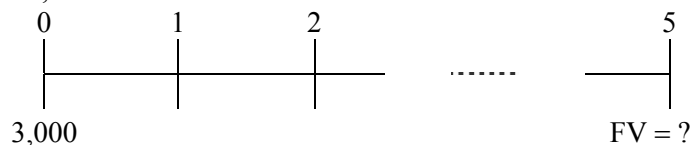
- b. $FV_{10} = 3,000 \times 1.08^{10}$
 $= 6,476.77$



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	8.00%	3000.00	0		
Solve for FV:					(\$6476.77)	=FV(0.08,10,0,3000)

c. $FV_5 = 3,000 \times 1.16^5$

$= 6,301.02$



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5	16.00%	3000.00	0		

Solve for FV: **(\$6301.02)** $=FV(0.16,5,0,3000)$

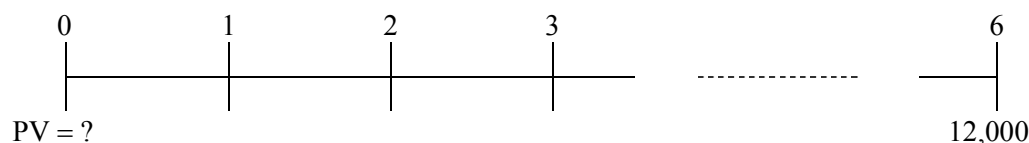
d.* Evaluate: Since with compound value in the last 5 years you get interest on the interest earned in the first 5 years as well as interest on the original \$3,000, the value at the end of 10 years (\$6,476.77) is significantly greater than the value after 5 years (\$4,407.98).

- 20. Plan:** Determine the present values of the different interest rates and the different time periods. Compare the differences in present values.

Execute:

a. $PV = 12,000 / 1.05^6$

$= 8,954.58$

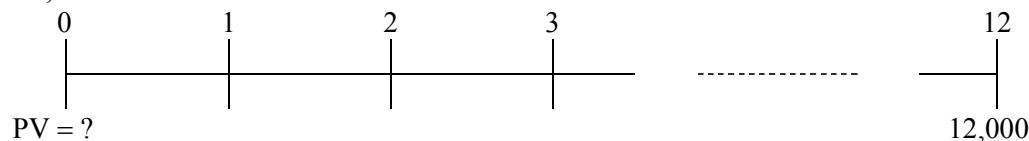


	N	I/Y	PV	PMT	FV	Excel Formula
Given:	6	5.00%		0	-12,000	

Solve for PV: **8954.58** $=PV(0.05,6,0,-12000)$

b. $PV = 12,000 / 1.08^{12}$

$= 4,765.37$

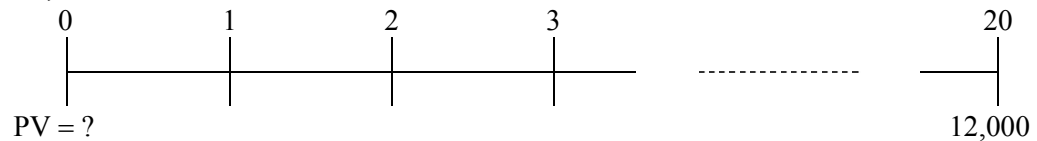


	N	I/Y	PV	PMT	FV	Excel Formula
Given:	12	8.00%		0	-12,000	

Solve for PV: **4765.37** $=PV(0.08,12,0,-12000)$

c. $PV = 12,000 / 1.10^{20}$

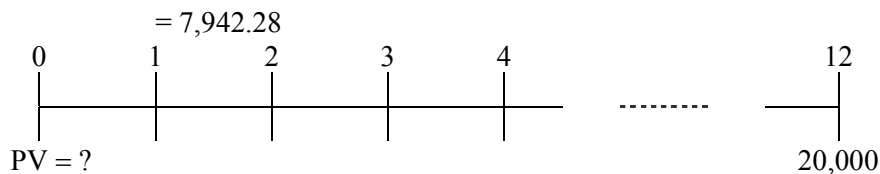
$= 1,783.72$



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20	10%		0	-12,000	
Solve for PV:			1783.72			=PV(0.1,20,0,-12000)

- 21. Plan:** You are being offered a choice between \$15,000 today and \$20,000 in 12 years. One way to evaluate this decision is determine how much the \$20,000 in 12 years is worth today. In this way, we can compare the \$15,000 today against the present value of the \$20,000 in 12 years.

Execute: $PV = 20,000 / 1.08^{12}$



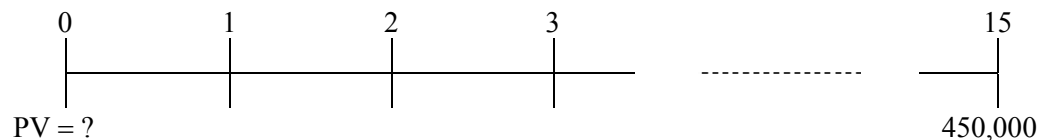
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	12	8.00%		0	-20,000	
Solve for PV:			7,942.28			=PV(0.08,12,0,-20000)

Evaluate: The 20,000 in 12 years is worth \$7,942.28 today. It is preferable to the \$15,000 payment today because it is worth more.

22. $FV = \$1,000(1.025)^2 + \$500(1.025) = \$1,563.13$

- 23. Plan:** Your aunt and uncle want to know what the present value of \$450,000 is in 15 years, discounted at 8% annually. Most likely they do not think of this decision in these terms and do not use or understand this terminology.

Execute: $PV = 450,000 / 1.08^{15} = 141,858.77$

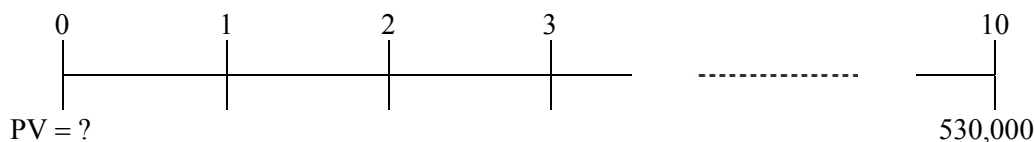


	N	I/Y	PV	PMT	FV	Excel Formula
Given:	15	8.00%		0	-450,000	
			141858.7			
Solve for PV:			7			=PV(0.08,15,0,-450000)

Evaluate: Your aunt and uncle would have to invest \$141,858.77 today at 8% compounded annual interest for it to grow in 15 years into the \$450,000 they will need to finance your cousin's education.

- 24. Plan:** Your mom is being offered a choice in how she will take her retirement benefit: either \$320,000 today or \$530,000 in ten years. If she wants the alternative that is going to give her the most wealth, then she should take the alternative with the highest net present value. Your job is to determine the present values of the \$530,000 in ten years at different interest rates.

Execute:



a. $PV = 530,000 / 1.0^{10}$
 $= 530,000$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	0.00%		0	-530,000	
Solve for PV:			530,000.00			=PV(0,10,0,-530000)

b. $PV = 530,000 / 1.20^{10}$
 $= 85,597.96$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	20%		0	-530,000	
Solve for PV:			85597.96			=PV(0.2,10,0,-530000)

c. $PV = 530,000 / 1.08^{10}$
 $= 245,492.55$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	8%		0	-530,000	
Solve for PV:			245492.55			=PV(0.08,10,0,-530000)

Evaluate:

- If the interest rate is zero, an unlikely situation, then your mom should take the 530,000 in ten years. If she takes the \$320,000 today and invests it at 0% for ten years, she will have \$320,000 in ten years. \$530,000 is better in ten years than \$320,000.
- If the interest rate is 20%, she should take the 320,000 today.
- If the interest rate is 8%, she should take the 320,000 today.

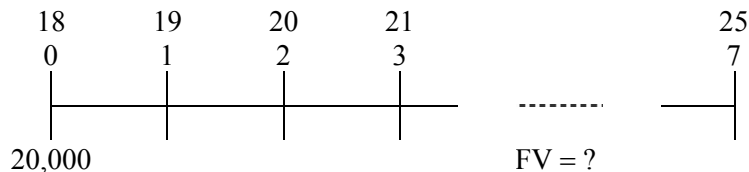
25. a. $85,000(1.07)^{40} = 1,272,828.92$

b. $85,000(1.07)^{30} = 647,041.68$

- *26. **Plan:** Parts (a) and (b) ask for future values, so we will use Eq. 3.1 to calculate those answers. Part (c) asks for the starting amount, which we can treat as a present value of the FV of \$20,000 in the account now. We will use Eq. 3.2 to discount that value back to the beginning.

a. $FV = 20,000(1.05)^{10}$
 $= 32,577.89$

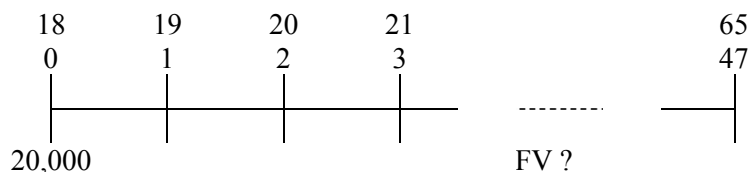
You would have \$32,577.89 at age 28, which is ten years from today.



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	5.00%	20000	0		
Solve for FV:					(32,577.89)	=FV(0.05,10,0, 20000)

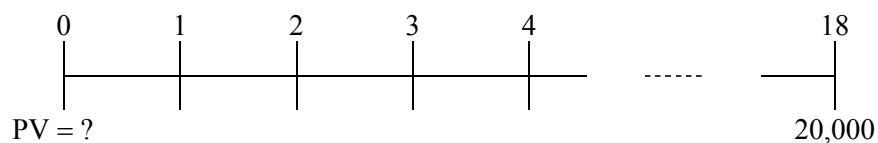
b. $FV = 20,000(1.05)^{47}$
 $= 198,119.42$

You would have \$198,119.42 at age 65, which is 47 years from today.



	N	I/Y	PV	PMT	FV	Excel Formula
Given:	47	5.00%	20000	0		
Solve for FV:					(198,119.42)	=FV(0.05,47,0, 20000)

$$\begin{aligned} \text{c. } PV &= \frac{20,000}{1.05^{18}} \\ &= 8,310.41 \end{aligned}$$



Eighteen years ago, your grandfather invested \$1,000 to create the fund you have today.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18	5.00%		0	-20000	
Solve for PV:			8,310.41			=PV(0.05,18,0, -20000)

Evaluate: Given time value of money tools you can calculate how much your grandfather invested in the past (using the PV equation) and how much the amount in your account will grow to at various dates in time (future value).

Chapter 4

Time Value of Money: Valuing Cash Flow Streams

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

Editor's Note: As we move forward to more complex financial analysis, the student will notice that some problems may contain a large amount of data from different time periods that require more complicated and intensive analysis. Modern information technology has evolved in the form of financial calculators with built-in analysis functions and Time Value of Money functions that are built into computer-based electronic spreadsheet software such as Excel. The solutions for many data- and computationally intensive problems will be presented in formula form with a solution, as well as with the appropriate financial calculator commands and Excel functions to produce the same correct answer. In this way, it is our expectation that students will develop proficiency in solving financial analysis problems by mathematical calculation as well as by using financial calculators and electronic spreadsheets.

1. a.

Year	1	2	3	4	5
CF	10	20	30	40	50

$$PV = \frac{10}{1.10} + \frac{20}{(1.10)^2} + \frac{30}{(1.10)^3} + \frac{40}{(1.10)^4} + \frac{50}{(1.10)^5} = 106.53$$

b.

Year	1	2	3	4	5
CF	50	40	30	20	10

$$PV = \frac{50}{1.10} + \frac{40}{(1.10)^2} + \frac{30}{(1.10)^3} + \frac{20}{(1.10)^4} + \frac{10}{(1.10)^5} = 120.92$$

- c. The present value is different because the timing of the cash flows is different. In the second set, you get the larger cash flows earlier, so it is more valuable to you and shows up as a higher PV.

2.

Year	1	2	3	4
CF	100	-100	200	-200

$$PV = \frac{100}{1.15} - \frac{100}{(1.15)^2} + \frac{200}{(1.15)^3} - \frac{200}{(1.15)^4} = 28.49$$

3.

Year	1	2	3	4	5
CF	10000	-2000	-3000	-3500	-3975

$$PV = \frac{2,000}{1.085} + \frac{3,000}{(1.085)^2} + \frac{3,500}{(1.085)^3} + \frac{3,975}{(1.085)^4} = 10,000.12$$

, so yes, the PV of your payments would just cover the loan amount (actually exceeding it by 12 cents). Thus, the maximum you could borrow would be 10,000.12

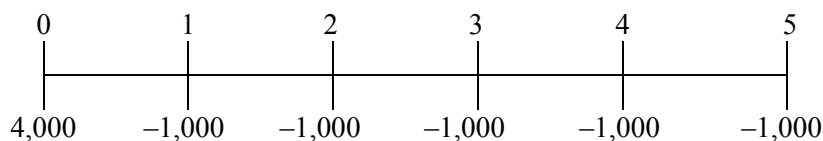
4.

Month	1	2	3	4	5	6	7	8
CF	500	550	600	650	700	750	800	850

$$PV = \frac{500}{1.015} + \frac{550}{(1.015)^2} + \frac{600}{(1.015)^3} + \frac{650}{(1.015)^4} + \frac{700}{(1.015)^5} + \frac{750}{(1.015)^6} + \frac{800}{(1.015)^7} + \frac{850}{(1.015)^8} = 5,023.75$$

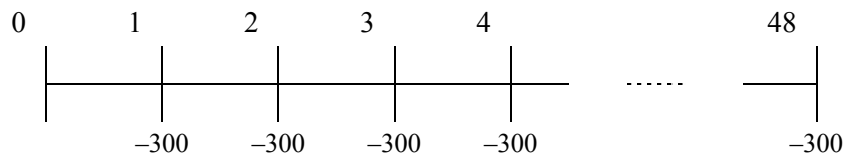
So, the PV of your payments will exceed the loan balance. This means that your planned payments will be enough to payoff your credit card.

5.



From the bank's perspective, the timeline is the same except all the signs are reversed.

6.

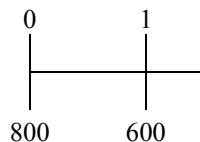


From the bank's perspective, the timeline would be identical except with opposite signs.

7. **Plan:** Draw the timeline and then compute the FV of these two cash flows.

Execute:

Timeline (because we are computing the future value of the account, we will treat the cash flows as positive—going into the account):



FV = ?

$$FV = 800(1.05) + 600 = 1,440$$

Evaluate:

The timeline helps us organize our work so that we get the number of periods of compounding correct. The first cash flow will have 1 year of compounding, but the second cash flow will be deposited at the end of period 1, so it receives no compounding.

8. *Editor's Note:* In several previous problems, we used a financial calculator to solve a time value of money problem. Problems could be solved quickly and easily by manipulating the N, I/Y, PV, PMT, and FV keys. In each of these problems, there was a series of payments of equal amount over time, i.e., an annuity. All you had to do to input this series was enter the payment (PMT) and the number of payment (N).

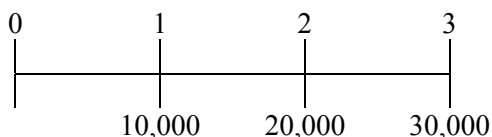
Many financial analysis problems involve a series of equal payments, but others involve a series of unequal payments. A financial calculator can be used to evaluate an unequal series of cash flows (using the cash flow (CF) key), but the process is cumbersome because each cash flow must be entered individually. I urge each student to study the Chapter 4 Appendix: "Using a Financial Calculator," as well as instructional materials that are produced by the manufacturers of the financial calculator.

Here we will solve a problem with uneven cash flows mathematically and with a financial calculator.

Plan: It is wonderful that you will receive this windfall from your investment in your friend's business. Because the cash flow payments to you are of different amounts and paid over three years, there are different ways in which you can think about how much money you are receiving.

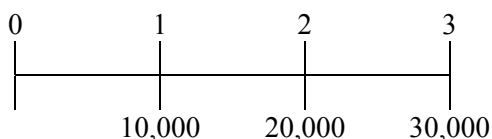
Execute:

$$\begin{aligned}
 \text{a. } PV &= \frac{10,000}{1.035} + \frac{20,000}{1.035^2} + \frac{30,000}{1.035^3} \\
 &= 9,662 + 18,670 + 27,058 \\
 &= 55,390
 \end{aligned}$$



The Texas Instrument BA II PLUS calculator has a cash flow worksheet accessed with the CF key. To clear all previous values that might be stored in the calculator, press the CF, second, and CE/C buttons. The screen should show $CF_0 =$ asking for the cash flow at time 0, which in this problem is 0. Press 0, then press enter, and then the down key button. The screen should show CO_1 asking for the cash flow at time 1, which in this problem is 10,000. Input 10,000 followed by the enter key, followed by the down button. The screen should show $FO_1 = 1.0$ asking for the frequency of this cash flow. Because it occurs only once, it is correct, and we press the down key. The screen now has CO_2 asking for the time 2 cash flow, which is 20,000, which we input, followed by the enter key and the down key. The screen now has $FO_2 = 1.0$, which is correct. Enter the down key, which asks for the third cash flow, which is 30,000. Input 30,000, followed by the enter and down keys. Now press the NPV key, and the calculator will display $I =$ asking for the interest rate, which is 3.5. Input 3.5, press the enter key, and press the down key, and the screen will display NPV =. Then press the CPT button, and the screen should display 55,390.33, the Net Present Value.

$$\begin{aligned}
 \text{b. } FV &= 55,390 \times 1.035^3 \\
 &= 61,412
 \end{aligned}$$



Evaluate: You may ask: “How much better off am I because of this windfall?” There are several answers to this question. The value today (i.e., the present value) of the cash you will receive over three years is \$55,390. If you decide to reinvest the cash flows as you receive them, then in three years you will have \$61,412 (i.e., future value) from your windfall.

9. **Plan:** Use Eq. 4.3 to compute the PV of this stream of cash flows and then use Eq. 4.1 to compute the FV of that present value. To answer part (c), you need to track the new deposit made each year along with the interest on the deposits already in the bank.

Execute:

$$\begin{aligned}
 \text{a. and b. } PV &= \frac{100}{(1.08)} + \frac{100}{(1.08)^2} + \frac{100}{(1.08)^3} = 257.71 \\
 FV &= 257.71(1.08)^3 = 324.64
 \end{aligned}$$

c. Year 1: 100

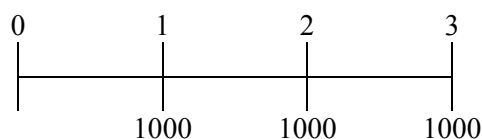
$$\text{Year 2: } 100(1.08)^1 + 100 = 208$$

$$\text{Year 3: } 208(1.08)^1 + 100 = 324.64$$

Evaluate:

By using the PV and FV tools, we are able to keep track of our balance as well as quickly calculate the balance at the end. Whether we compute it step by step as in part (c) or directly as in part (b), the answer is the same.

10. Plan: First, create a timeline to understand when the cash flows are occurring.



Second, calculate the present value of the cash flows.

Once you know the present value of the cash flows, compute the future value (of this present value) at date 3.

$$\begin{aligned}\text{Execute: PV} &= \frac{1,000}{1.05} + \frac{1,000}{1.05^2} + \frac{1,000}{1.05^3} \\ &= 952 + 907 + 864 \\ &= 2,723\end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	3	5.00%		-1,000	0	
Solve for PV:			2,723.25			=PV(0.05,3,-1,000,0)

$$\begin{aligned}\text{FV}_3 &= 2,723 \times 1.05^3 \\ &= 3,152\end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	3	5.00%	-2,723.43	0		
Solve for FV:					3,152.71	=FV(0.05,3,0,-2,723.43)

Evaluate: Because of the bank's offer, you now have two choices as to how you will repay this loan. Either you will pay the bank \$1,000 per year for the next three years as originally promised, or you can decide to skip the three annual payments of \$1,000 and pay \$3,152 in year three.

You now have the information to make your decision.

11. a. The FV of 100,000 invested for 35 years at 9% is $100,000 \times (1.09)^{35} = 2,041,397$

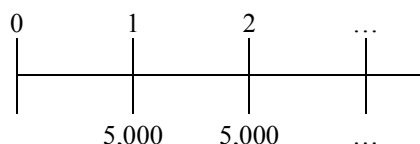
b. The FV of 100,000 invested for 25 years at 9% is $100,000 \times (1.09)^{25} = 862,308$

- c. The difference is so large because of the effect of compounding, which is exponential. In the scenario where you invest earlier, those 10 years are critical to the compound growth you achieve on your investment.

12. Plan: This scholarship is a perpetuity. The cash flow is \$5,000 and the discount rate is 6%.

Execute:

Timeline:

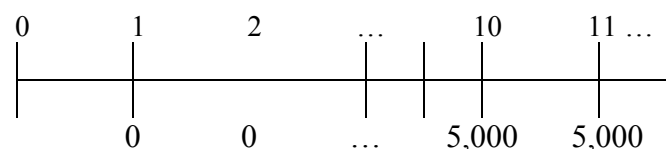


$$PV = 5,000/0.06 = 83,333.33$$

Evaluate:

With a donation of \$83,333.33 today and 6% interest, the university can withdraw the interest every year (\$5,000) and leave the endowment intact to generate the next year's \$5,000. It can keep doing this forever.

13. Plan: This is a deferred perpetuity. Here is the timeline:



Do this in two steps:

1. Calculate the value of the perpetuity in year 9, when it will start in only one year (we already did this in problem 12).
2. Discount that value back to the present.

Execute:

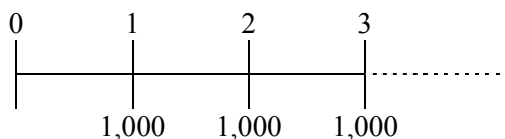
The value in year 9 is $5,000/0.06 = 83,333.33$.

The value today is $83,333.33/1.06^9 = 49,324.87$

Evaluate:

Because your endowment will have 10 years to earn interest before making its first payment, you can endow the scholarship for much less. The value of your endowment must reach \$83,333.33 the year before it starts (in 9 years). If you donate \$49,324.87 today, it will grow at 6% interest for 9 years, just reaching \$83,333.33, one year before the first payment.

14. The timeline for this investment is:



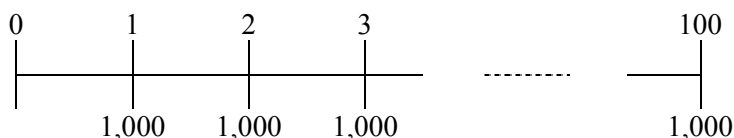
- a. The value of the bond is equal to the present value of the cash flows. By the perpetuity formula, which assumes the first payment is at period 1, the value of the bond is:

$$PV = 1,000 / 0.08 = \text{£}12,500$$

- b. The value of the bond is equal to the present value of the cash flows. The first payment will be received at time zero. The cash flows are the perpetuity plus the payment that will be received immediately.

$$PV = 1,000 / 0.08 + 1,000 = \text{£}13,500$$

15. **Plan:** Draw the timeline of the cash flows for the investment opportunity. Compute the NPV of the investment opportunity at 7% interest per year to determine its value.



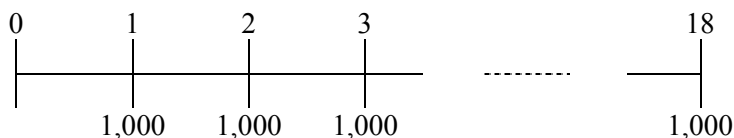
Execute: The cash flows are a 100-year annuity, so by the annuity formula:

$$PV = \frac{1,000}{0.07} \left(1 - \frac{1}{1.07^{100}} \right) = 14,269.25$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	100	7.00%		1,000	0	
Solve for PV:			(14,269.25)			=PV(0.07,100,1000,0)

Evaluate: The PV of \$1,000 to be paid every year for 100 years discount to the present at 7% is \$14,269.25.

16. **Plan:** Prepare a timeline of your grandmother's deposits.



The deposits are an 18-year annuity. Use Eq. 4.6 to calculate the future value of the deposits.

Execute: $FV = C \times \frac{1}{r} [(1+r)^N - 1] = 1,000 \frac{1}{0.03} [(1.03)^{18} - 1] = 23,414.43$

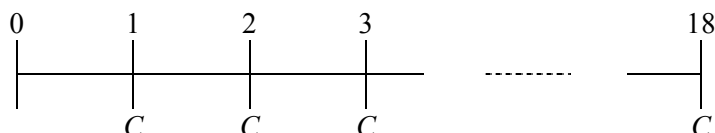
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18	3.00%	0	1,000		
Solve for FV:					(23,414.43)	=FV(0.03,18,1000,0)

At age 18, you will have \$23,414.43 in your account.

Evaluate:

The interest on the deposits and interest on that interest adds more than \$5,414 to the account.

17. a.



First, we need to calculate the PV of \$160,000 in 18 years.

$$\begin{aligned} PV &= \frac{160,000}{(1.08)^{18}} \\ &= 40,039.84 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18	8.00%		0	160,000	
Solve for PV:			(40,039.84)			=PV(0.08,18,0,160000)

In order for the parents to have \$160,000 in your college account by your 18th birthday, the 18-year annuity must have a PV of \$40,039.84. Solving for the annuity payments:

$$\begin{aligned} C &= \frac{40,039.84}{\frac{1}{0.08} \left(1 - \frac{1}{1.08^{18}} \right)} \\ &= \$4,272.33 \end{aligned}$$

which must be saved each year to reach the goal.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18	8.00%	40,039.84		0	
Solve for PMT:				(4,272)		=PMT(0.08,18,40039.84,0)

b. First, we need to calculate the PV of \$200,000 in 18 years.

$$\begin{aligned} PV &= \frac{200,000}{(1.08)^{18}} \\ &= 50,049.81 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18	8.00%		0	200,000	
Solve for PV:			(50,049.81)			=PV(0.08,18,0,200000)

In order for the parents to have \$200,000 in your college account by your 18th birthday, the 18-year annuity must have a PV of \$50,049.81. Solving for the annuity payments:

$$C = \frac{\$50,049.81}{\frac{1}{0.08} \left(1 - \frac{1}{1.08^{18}} \right)}$$

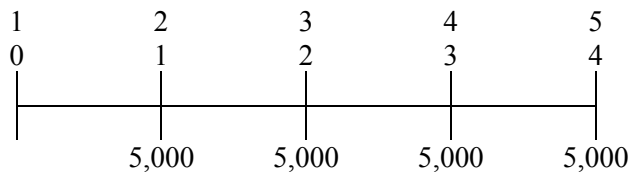
$$= \$5340.42$$

which must be saved each year to reach the goal.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	18.00	0.08	50,049.81		0.00	
Solve for PMT:				-5340.42		=PMT(0.08,18,50049.81,0)

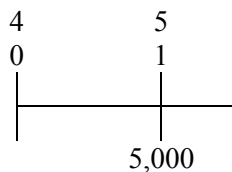
***18. Plan:**

- a. Draw the timeline of the cash flows for the loan.



To pay off the loan, you must repay the remaining balance. The remaining balance is equal to the present value of the remaining payments. The remaining payments are a four-year annuity, so:

- b.



Execute:

a. $PV = \frac{5,000}{0.06} \left(1 - \frac{1}{1.06^4} \right)$

$$= 17,325.53$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4	6.00%		5000	0	
Solve for PV:			(17,325.53)			=PV(0.06,4,5000,0)

$$\begin{aligned} \text{b. } PV &= \frac{5,000}{1.06} \\ &= 4,716.98 \end{aligned}$$

Evaluate: To pay off the loan after owning the vehicle for one year will require \$17,325.53. To pay off the loan after owning the vehicle for four years will require \$4,716.98.

19. Plan: This is a deferred annuity. The cash flow timeline is:

0	1 ...	17	18...	21
	0 ...	0	100,000 ...	100,000

Calculate the value of the annuity in year 17, one period before it starts using Eq. 4.5 and then discount that value back to the present using Eq. 4.2.

The value of the annuity in year 17, one period before it is to start is:

$$PV = \frac{CF}{r} \left[1 - \frac{1}{(1+r)^n} \right] = \frac{100,000}{0.08} \left[1 - \frac{1}{(1.08)^4} \right] = 331,212.68$$

To get its value today, we need to discount that lump sum amount back 17 years to the present:

$$\frac{331,212.68}{(1.08)^{17}} = \$89,516.50$$

Evaluate:

Even though the cash flows are a little unusual (an annuity starting well into the future), we can still value them by combining the PV of annuity and PV of a FV tool. If we invest \$89,516.50 today at an interest rate of 8%, it will grow to be enough to fund an annuity of \$100,000 per year by the time it is needed for college expenses.

20. Plan: This is a deferred annuity. The cash flow timeline is:

0	1 ...	44	45...	60
	0 ...	0	40,000 ...	40,000

Calculate the value of the annuity in year 44, one period before it starts using Eq. 4.5 and then discount that value back to the present using Eq. 4.2.

Execute:

The value of the annuity in year 44, one period before it is to start is:

$$PV = \frac{CF}{r} \left[1 - \frac{1}{r(1+r)^n} \right] = \frac{40,000}{0.07} \left[1 - \frac{1}{(1.07)^{16}} \right] = 377,865.94$$

To get its value today, we need to discount that lump sum amount back 44 years to the present:

$$\frac{377,865.94}{(1.07)^{44}} = \$19,250.92$$

Evaluate:

Even though the cash flows are a little unusual (an annuity starting well into the future), we can still value them by combining the PV of annuity and PV of a FV tool. The total value to you today of Social Security's promise is less than \$20,000.



***21. Plan:** Clearly, Mr. Rodriguez's contract is complex, calling for payments over many years.

Assume that an appropriate discount rate for A-Rod to apply to the contract payments is 7% per year.

- Calculate the true promised payments under this contract, including the deferred payments with interest.
- Draw a timeline of all of the payments.
- Calculate the present value of the contract.
- Compare the present value of the contract to the quoted value of \$252 million. What explains the difference?

Execute: Determine the PV of each of the promised payments discounted to the present at 7%.

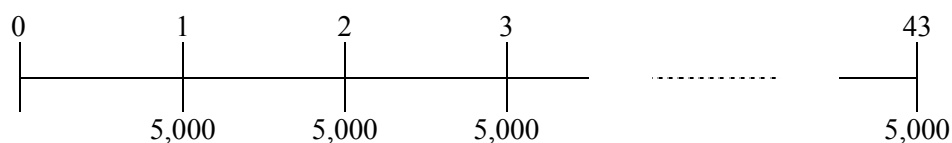
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
\$18M	19M	19M	19M	21M	19M	23M	27M	27M	27M
2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
6.7196M	5.3757M	4.0317M	4.0317M	4.0317M	4.0317M	4.0317M	4.0317M	4.0317M	4.0317M

The PV of the promised cash flows is \$165.77 million.

Evaluate: The PV of the contract is much less than \$252 million. The \$252 million value does not discount the future cash flows or adjust deferred payments for accrued interest.



***22. a.**



The amount in the retirement account in 43 years would be:

$$\begin{aligned}
 FV_{43} &= \frac{5,000}{0.10} [(1.10)^{43} - 1] \\
 &= \$2,962,003.46
 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43	10.00%	0.00	-5,000		

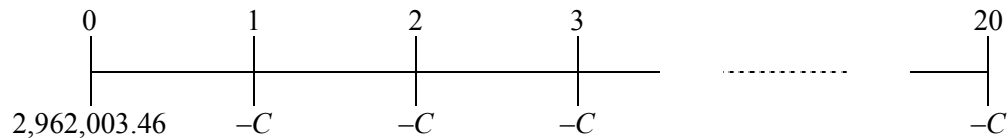
Solve for FV: **2,962,003.46** =FV(0.1,43,-5000,0)

- b. To solve for the lump sum amount today, find the PV of the \$2,962,003.46.

$$\begin{aligned} PV &= \frac{2,962,003.46}{(1.10)^{43}} \\ &= \$49,169.99 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43	10.00%		0	2,962,003	
Solve for PV:			(49,169.99)			=PV(0.1,43,0,2962003.46)

c.

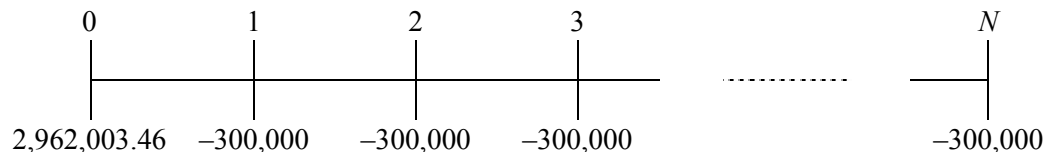


Solve for the annuity cash flow that, after 20 years, exactly equals the starting value of the account.

$$\begin{aligned} C &= \frac{2,962,003.46}{\frac{1}{0.10} \left(1 - \frac{1}{1.10^{20}} \right)} \\ &= 347,915.81 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20.00	0.10	2,962,003.46		0.00	
Solve for PMT:				-347,915.81		=PMT(0.1,20,2962003.46,0)

d.



We want to solve for N , which is the length of time in which the PV of annual payments of \$300,000 will equal \$2,962,003.46. Setting up the PV of an annuity formula and solving for N :

$$\begin{aligned}\frac{300,000}{0.10} \left(1 - \frac{1}{1.10^N} \right) &= 2,962,003.46 \\ \left(1 - \frac{1}{1.10^N} \right) &= \frac{2,962,003.46 \times 0.10}{300,000} = 0.9873345 \\ \frac{1}{1.10^N} &= 1 - 0.9873345 = 0.0126655 \\ 1.10^N &= 78.95456 \\ N &= \frac{\text{Log}(78.95456)}{\text{Log}(1.10)} = 45.84\end{aligned}$$

- e. If we can only invest \$1,000 per year, then set up the PV formula using \$1 million as the FV and \$1,000 as the annuity payment.

$$\frac{1,000}{r} \left(1 - \frac{1}{(1+r)^{43}} \right) = 1,000,000$$

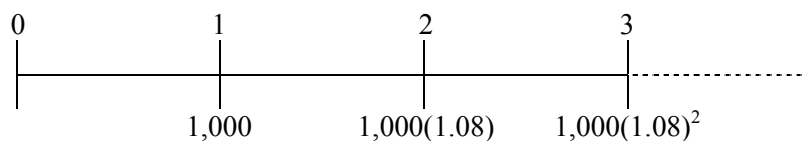
To solve for r , we can either guess or use the annuity calculator. You can check and see that $r = 11.74291\%$ solves this equation. So the required rate of return must be 11.74291%.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43		0.00	-1,000	1,000,000	
Solve for Rate:		11.74291%				=RATE(43,-1000,0,1000000)

- 23. Plan:** The bequest is a perpetuity growing at a constant rate. The bequest is identical to a firm that pays a dividend that grows forever at a constant rate. We can use the constant dividend growth model to determine the value of the bequest.

Execute:

a.

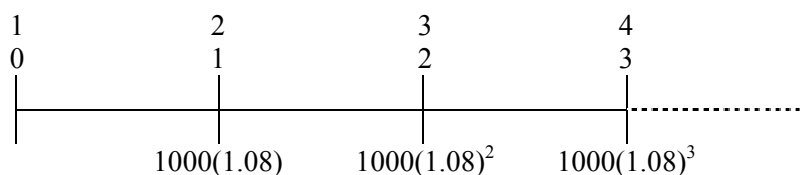


Using the formula for the PV of a growing perpetuity gives

$$\begin{aligned}\text{PV} &= \left(\frac{1,000}{0.12 - 0.08} \right) \\ &= 25,000\end{aligned}$$

which is the value today of the bequest.

b.



Using the formula for the PV of a growing perpetuity gives:

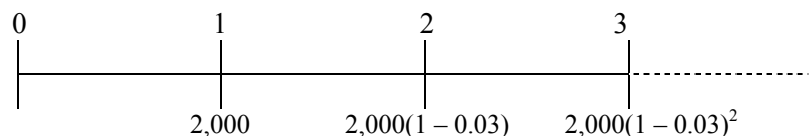
$$\begin{aligned} PV &= \frac{1,000(1.08)}{0.12 - 0.08} \\ &= 27,000 \end{aligned}$$

which is the value of the bequest after the first payment is made.

Evaluate: The bequest is worth \$25,000 today and will be worth \$27,000 in 1 year's time.

- *24. Plan:** The machine will produce a series of savings that are growing at a constant rate. The rate of growth is negative, but the constant growth model can still be used.

Execute: The timeline for the saving would look as follows:



We must value a growing perpetuity with a *negative* growth rate of -0.03 :

$$\begin{aligned} PV &= \frac{2,000}{0.08 - (-0.03)} \\ &= \$18,181.82 \end{aligned}$$

Evaluate: The value of the savings produced by the machine is worth \$18,181.82 today.

- 25. Plan:** Nobel's bequest is a perpetuity. The total amount is $5 \times \$45,000 = \$225,000$. With a cash flow of \$225,000 and an interest rate of 7% per year, we can use Eq. 4.4 to solve for the total amount he would need to use to endow the prizes. In part (b), we will need to use the formula for a growing perpetuity (Eq. 4.7) to find the new value he would need to leave. Finally, in part (c), we can use the FV equation (Eq. 4.1) to solve for the future value his descendants would have had if they had kept the money and invested it at 7% per year.

- a. In order to endow a perpetuity of \$225,000 per year with a 7% interest rate per year, he would need to leave $\$225,000/0.07 = \$3,214,285.71$.

- b. In order to endow a growing perpetuity with an interest rate of 7% and a growth rate of 4% and an initial cash flow of \$225,000, he would have to leave:

$$PV = \frac{CF_1}{r - g} = \frac{225,000}{0.07 - 0.04} = 7,500,000$$

c. $FV = PV(1 + r)^n = 7,500,000(1.07)^{118} = \$ 21,996,168,112$

Evaluate:

The prizes that bear Nobel's name were very expensive to endow—\$3 million was an enormous sum in 1896. However, Nobel's endowment has been able to generate enough interest each year to fund the prizes, which now have a cash award of approximately \$1,500,000 each!

- 26. Plan:** The drug will produce 17 years of cash flows that will grow at 5% annually. The value of this stream of cash flows today must be determined. We can use the formula for a growing annuity (Eq. 4.8) or Excel to solve this. $C = 2$, $r = 0.10$, $g = 0.05$, $N = 17$

Execute: $PV = 2 \left(\frac{1}{0.10 - 0.05} \right) \left(1 - \left(\frac{1.05}{1.10} \right)^{17} \right) = 21.86$

Because the cash flows from this investment will continue for 17 years, we decided to solve for the Net Present Value by using the NPV function in Excel. This is shown on the next page. The 17 cash flows are presented in columns C, D, ... S. The initial cash flow of \$2M is presented in cell C8, and each subsequent cash flow grows at 5% until \$4.365749M is presented in year 17 in cell S8. (Note that columns G through Q are not presented.) The NPV of the project is calculated using the NPV formula = NPV(C3,C8:S8) in cell B10. The NPV of the future cash flows is \$21.86M.

	A	B	C	D	E	F	R	S
1								
2		1+g	1.05					
3		r	0.1					
4								
5								
6	T	0	1	2	3	4	16	17
7								
8			2	2.1	2.205	2.31525	4.157856	4.365749
9								
10	NPV	\$21.86						
11								
12		EXCEL NPV FORMULA	=NPV(C3,C8:S8)					
13								

Evaluate: The value today of the cash flows produced by the drug over the next 17 years is \$21.86 million. Because the cash flows are expected to grow at a constant rate, we can use the growing annuity formula as a shortcut.

- 27. Plan:** Your rich aunt is promising you a series of cash flows over the next 20 years. You must determine the value of those cash flows today. This is a growing annuity and we can use Eq. 4.8 to solve it, or we can also solve it in Excel. $C = 5$, $r = 0.03$, $g = 0.05$ and $N = 20$

Execute: $PV = 5 \left(\frac{1}{0.05 - 0.03} \right) \left(1 - \left(\frac{1.03}{1.05} \right)^{20} \right) = 79.82$

Because the cash flows from this investment will continue for 20 years, we decided to solve for the Net Present Value by using the NPV function in Excel. This is shown on the next page. The 20 cash flows are presented in columns C, D, ... V. The initial cash flow of \$5,000 is presented in cell C8, and each subsequent cash flow grows at 3% until \$8,767.53 is presented in year 20 in cell V8. (Note that columns G through R are not presented.) The NPV of the project is calculated using the NPV formula = NPV(C3,C8:V8) in cell B10. The NPV of the future cash flows is \$79,824.

	A	B	C	D	E ...	S	T	U	V
1									
2		1 + g	1.03						
3		r	0.05						
4									
5									
6	T	0	1	2	3	17	18	19	20
7									
8			5	5.15	5.3045	8.023532	8.264238	8.51216	8.76753
9									
10	NPV	\$79.82							
11									
12		EXCEL NPV FORMULA	=NPV(C3,C8:V8)						
13									

Evaluate: Because your aunt will be increasing what she gives each year at a constant rate, we can use the growing perpetuity formula as a shortcut to value the stream of cash flows. Her gift is quite generous: It is equivalent to giving you almost \$80,000 today!

- 28. Plan:** This problem is asking us to solve for the rate of return (r). Because there are no recurring payments, we can use Eq. 4.1 to represent the problem and then just solve algebraically for r . We have $FV = 200$, $PV = 100$, $n = 10$.

Execute:

$$FV = PV(1 + r)^n$$

$$200 = 100(1 + r)^{10}, \text{ so } r = (200/100)^{1/10} - 1 = 0.072 \text{ or } 7.2\%$$

Evaluate:

The implicit return we earned on the savings bond was 7.2%. Our money doubled in 10 years, which by the rule of 72 meant that we earned about $72/10 = 7.2\%$ and our calculation confirmed that.

- 29. Plan:** This problem is again asking us to solve for r . We will represent the investment with Eq. 4.1 and solve for r . We have $PV = 2,000$, $FV = 10,000$, $n = 10$. The second part of the problem asks us to change the rate of return going forward and calculate the FV in another 10 years.

Execute:

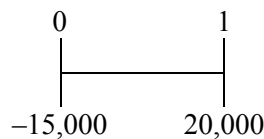
a. $FV = PV(1 + r)^n$

$$10,000 = 2,000(1 + r)^{10}, \text{ so } r = (10,000/2,000)^{1/10} - 1 = 0.1746, \text{ or } 17.46\%$$

b. $FV = 10,000(1.12)^{10} = \$31,058.48$

- 30. Plan:** Draw a timeline and determine the IRR of the investment.

Execute:



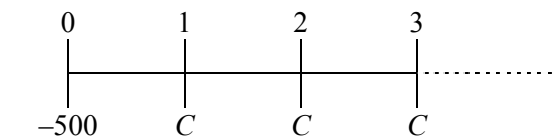
IRR is the r that solves:

$$15,000 = 20,000/(1 + r), \text{ so } r = (20,000/15,000) - 1 = 33.33\%$$

Evaluate: You are making a 33.33% IRR on this investment.

- 31. Plan:** Draw a timeline to demonstrate when the cash flows will occur. Then solve the problem to determine the payments you will receive.

Execute:



$$P = C/r,$$

$$\text{So, } C = P \times r$$

$$= 500 \times 0.08$$

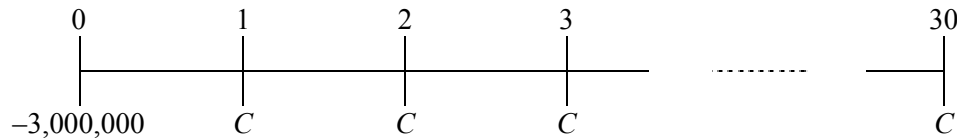
$$= \$40$$

Evaluate: You will receive \$40 per year into perpetuity.

- 32. Plan:** Draw a timeline to determine when the cash flows occur. Solve the problem to determine the annual payments.

Timeline (from the perspective of the bank):

Execute:



$$C = \frac{3,000,000}{\frac{1}{0.05} \left(1 - \frac{1}{1.05^{20}} \right)} = \$240,727.76$$

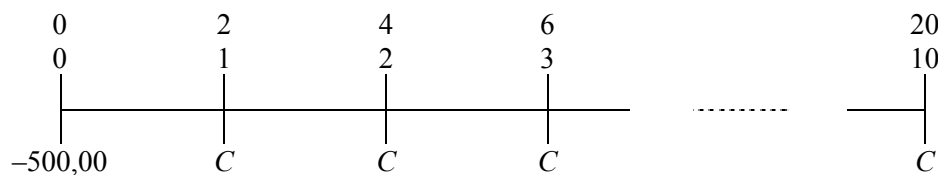
which is the annual payment.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20	5.00%	-3000000		0	
Solve for PMT:				\$240727.76		=PMT(0.05,20,-3000000,0)

Evaluate: You will have to pay the bank \$240,727.76 per year for 20 years in mortgage payments.

- *33. Plan:** Draw a timeline to demonstrate when the cash flows will occur. Determine the annual payments.

Execute:



This cash flow stream is an annuity. First, calculate the two-year interest rate: The one-year rate is 4%, and \$1 today will be worth $(1.04)^2 = 1.0816$ in two years, so the two-year interest rate is 8.16%. Using the equation for an annuity payment:

$$C = \frac{50,000}{\frac{1}{0.0816} \left(1 - \frac{1}{(1.0816)^{10}} \right)} = \$7,505.34$$

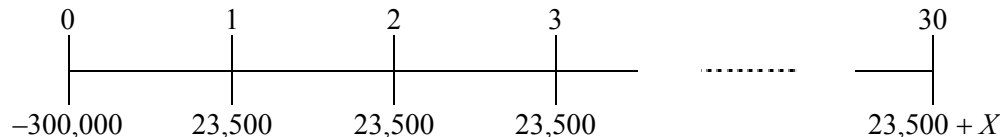
which is the payment you must make every two years.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	8.16%	-50,000.00		0	
Solve for PMT:				\$7,505.34		=PMT(0.0816,10,-50000,0)

Evaluate: You must pay the art dealer \$7505.34 every two years for 20 years.



***34. Plan:** Draw a timeline to determine when the cash flows occur. Timeline (where X is the balloon payment):



Note that the PV of the loan payments must be equal to the amount borrowed.

Execute:

$$300,000 = \frac{23,500}{0.07} \left(1 - \frac{1}{1.07^{30}} \right) + \frac{X}{(1.07)^{30}}$$

Solving for X :

$$\begin{aligned} X &= \left[300,000 - \frac{23,500}{0.07} \left(1 - \frac{1}{1.07^{30}} \right) \right] (1.07)^{30} \\ &= \$63,848 \end{aligned}$$

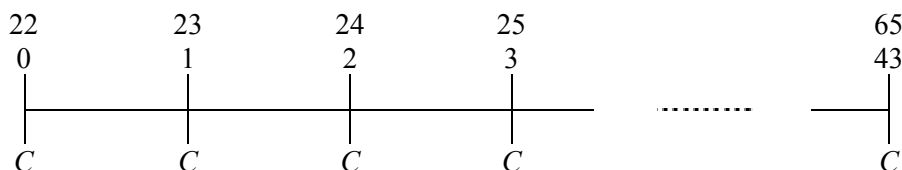
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	30	7.00%		-23,500	0	
Solve for PV:			291,612.47			=PV(0.07,30,-23500,0)

The present value of the annuity is \$291,612.47, which is \$8,387.53 less than the \$300,000.00. To make up for this shortfall with a balloon payment in year 30 would require a payment of \$63,848.02.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	30	7.00%	8,387.53	0		
Solve for FV:					(63,848.02)	=FV(0.07,30,0,8387.53)

Evaluate: At the end of 30 years you would have to make a \$63,848 single (balloon) payment to the bank.

- *35. Plan:** Draw a timeline to demonstrate when the cash flows occur. We know that you intend to fund your retirement with a series of annuity payments and the future value of that annuity is \$2 million.



Execute: $FV = \$2$ million.

The PV of the cash flows must equal the PV of \$2 million in 43 years. The cash flows consist of a 43-year annuity, plus the contribution today, so the PV is:

$$PV = \frac{C}{0.05} \left(1 - \frac{1}{(1.05)^{43}} \right) + C$$

The PV of \$2 million in 43 years is:

$$\frac{2,000,000}{(1.05)^{43}} = \$245,408.80$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43	5.00%		0	2,000,000	
Solve for PV:			(245,408.80)			=PV(0.05,43,0,2000000)
Setting these equal gives						

$$\begin{aligned} \frac{C}{0.05} \left(1 - \frac{1}{(1.05)^{43}} \right) + C &= 245,408.80 \\ \Rightarrow C &= \frac{245,408.80}{\frac{1}{0.05} \left(1 - \frac{1}{(1.05)^{43}} \right) + 1} = \$13,232.50 \end{aligned}$$

We need \$245,408.80 today to have \$2,000,000 in 43 years. If we do not have \$245,408.80 today, but wish to make 44 equal payments (the first payment is today, making the payments an annuity due) then the relevant Excel command is:

$$=PMT(rate,nper,pv,(fv),type) = PMT(.05,44,245,408.80,0,1) = 13,232.50$$

Type is set equal to 1 for an annuity due as opposed to an ordinary annuity.

Evaluate: You would have to put aside \$13,232.50 annually to have the \$2 million you wish to have in retirement.



- 36. Plan:** This problem is asking you to solve for n . You can do this mathematically using logs, or with a financial calculator or Excel. Because the problem happens to be asking how long it will

take our money to double, we can estimate the answer using the rule of 72: $72/10 = 7.2$, so the answer will be approximately 7.2 years.

Execute:
$$N = \frac{\ln\left(\frac{20000}{10000}\right)}{\ln(1.10)} = 7.27$$

Using a financial calculator or Excel:

N	I/Y	PV	PMT	FV
	10	-10000	0	20000
7.27				

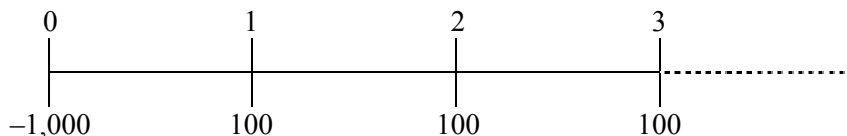
Excel Formula: `=NPER(RATE,PMT,PV,FV)` =
`NPER(0.10,0,-10000,20000)`

Evaluate:

If you can earn 10% per year on the \$10,000, it will double to \$20,000 in 7.27 years.

37. Plan: Draw the timeline and determine the interest rate the bank is paying you.

Execute:



The payments are a perpetuity, so $PV = \frac{100}{r}$.

Setting the NPV of the cash flow stream equal to 0 and solving for r gives the IRR:

$$NPV = 0 = \frac{100}{r} - 1,000 \Rightarrow r = \frac{100}{1,000} = 10\%$$

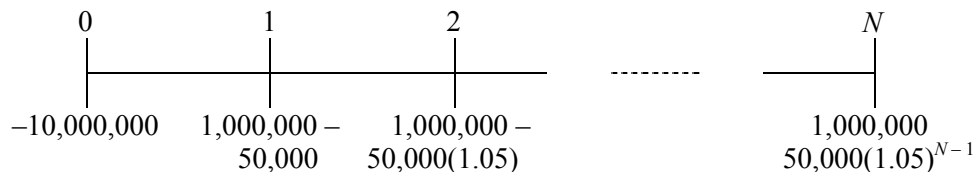
So the IRR is 10%.

Evaluate: The bank is paying you 10% on your deposit.



***38. Plan:** Draw a timeline to show when the cash flows occur. Then determine how long the plant will be in production. Also estimate the NPV of the project and hence whether or not it should be built.

Execute:



The plant will shut down when:

$$1,000,000 - 50,000(1.05)^{N-1} < 0$$

$$(1.05)^{N-1} > \frac{1,000,000}{50,000} = 20$$

$$(N-1)\log(1.05) > \log(20)$$

$$N > \frac{\log(20)}{\log(1.05)} + 1 = 62.4$$

So the last year of production will be in year 62.

We now build an Excel spreadsheet with the cash flows to the 62 years.

	A	B	C	D	E	F	G	BJ	BK	BL
1										
2		G	1.05							
3		R	0.06							
4										
5										
6	T	0	1	2	3	4	5	60	61	62
7										
8		-10000000	1000000	1000000	1000000	1000000	1000000	1000000	1000000	1000000
9			-50000	-52500	-55125	-57881.3	-60775.3	-889485	-933959	-980657
10		(\$10,000,000.00)	950000	947500	944875	942118.8	939224.7	110515	66040.71	19342.74
11										
12	NPV	\$3,995,073.97								
13		EXCEL NPV FORMULA =B10+NPV(C3,C11:BL11)								

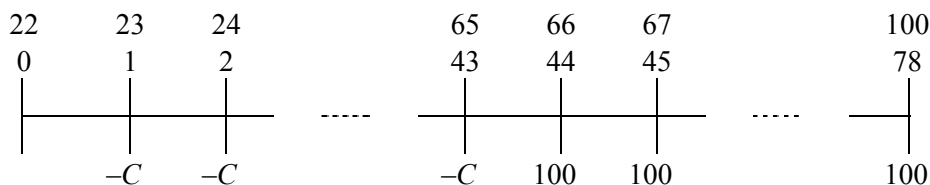
The Net Present Value of the project is computed in cell B12.

Evaluate: So, the NPV = 13,995,074 – 10,000 = \$3,995,074, and you should build it.



***39. Plan:** Draw a timeline to show when the cash flows will occur. Then determine how much you will have to put into the retirement plan annually to meet your goal.

Execute:



The PV of the costs must equal the PV of the benefits, so begin by dividing the problem into two parts: the costs and the benefits.

Costs: The costs are the contributions, a 43-year annuity with the first payment in one year:

$$PV_{\text{costs}} = \frac{C}{0.07} \left(1 - \frac{1}{(1.07)^{43}} \right)$$

Benefits: The benefits are the payouts after retirement, a 35-year annuity paying \$100,000 per year with the first payment 44 years from today. The value of this annuity *in year 43* is:

$$PV_{43} = \frac{100,000}{0.07} \left(1 - \frac{1}{(1.07)^{35}} \right)$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	35	7.00%		100,000	0	
Solve for PV:			(1,294,767.23)			=PV(0.07,35,100000,0)

The value today is just the discounted value in 43 years:

$$\begin{aligned} PV_{\text{benefits}} &= \frac{PV_{43}}{(1.07)^{43}} \\ &= \frac{100,000}{0.07(1.07)^{43}} \left(1 - \frac{1}{(1.07)^{35}} \right) \\ &= 70,581.24 \end{aligned}$$

Because the PV of the costs must equal the PV of the benefits (or equivalently, the NPV of the cash flow must be zero):

$$70,581.24 = \frac{C}{0.07} \left(1 - \frac{1}{(1.07)^{43}} \right)$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43	7.00%		0	1,294,767	
Solve for PV:			(70,581.24)			=PV(0.07,43,0,1294767.23)

Solving for C gives

$$\begin{aligned} C &= \frac{70,581.24 \times 0.07}{\left(1 - \frac{1}{(1.07)^{43}} \right)} \\ &= 5,225.55 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	43	7.00%	70,581.24		0	
Solve for PMT:				(5,226)		=PMT(0.07,43,70581.24,0)

Evaluate: You will have to invest \$5,225.55 annually into the retirement plan to meet your goal.

40. We calculate the future value as $FV = C \times (1 + r)^n$. The initial amount $C = \$5,000$ and the interest rate $r = 0.5\%$ per month. Because we have a monthly interest rate, we also need to express the number of periods, n , in months, so $n = 5 \times 12 = 60$. Thus,

$$FV = \$5,000 \times 1.00560 = \$6,744.25$$

We will have \$6,744.25 in the account in five years' time.

41. The \$5,000 cost is a monthly perpetuity. Using the perpetuity formula with monthly cash flows and the monthly interest rate, this cost has a present value of $\$5,000/0.005 = \1 million.
42. The most you can borrow is the PV of the payments you can afford. This is a PV of annuity problem but with monthly payments and a monthly interest rate. $CF = 200$, $r = 0.0075$, $n = 60$

$$PV = \frac{C}{r} \left[1 - \frac{1}{(1+r)^n} \right] = \frac{200}{0.0075} \left[1 - \frac{1}{(1.0075)^{60}} \right] = 9,634.67$$

Or using the annuity calculator:

Annuity Calculator PEARSON

NPER: 60

RATE: 0.75%

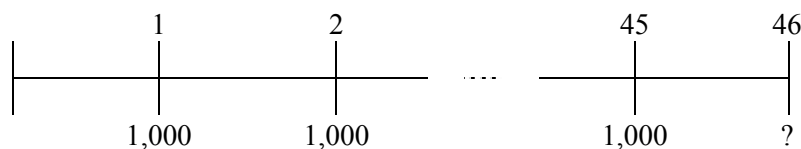
PV: (9,634.67)

PMT: 200.00

FV: 0.00

☐ Show timeline Clear berkdemarzo.com

43. We want to compute the future value of our account balance. Let's begin with the timeline over the next 46 months:



Our charges correspond to a 45-month annuity. Therefore, using the FV of an annuity formula, the future value at the end of 45 months is:

$$FV(\text{Annuity}) = \$1,000 \times \frac{1}{0.01}(1.01^{45} - 1) = \$56,481.07$$

Or using the annuity calculator:

The image shows a screenshot of an "Annuity Calculator" interface. The title "Annuity Calculator" is at the top left, and the "PEARSON" logo is at the top right. Below the title, there are five rows of input fields, each with a label button on the left and a text box on the right. The labels are "NPER", "RATE", "PV", "PMT", and "FV". The values entered in the text boxes are "45", "1.00%", "0.00", "1,000.00", and "(56,481.07)" respectively. At the bottom left, there is a checkbox labeled "Show timeline" which is unchecked. In the center bottom is a "Clear" button. At the bottom right is a small icon of a document with a list, followed by the text "berkdemarzo.com".

Label	Value
NPER	45
RATE	1.00%
PV	0.00
PMT	1,000.00
FV	(56,481.07)

☐ Show timeline berkdemarzo.com

Of course, we are not quite done. When we receive our statement in the 46th month, there will be one more month's worth of interest charged. Therefore, we will have a final balance of $\$56,481.07 \times 1.01 = \$57,045.89$.

Note that the future value formula for an annuity computes the future value as of the date of the last payment. In this question, we need to compute the future value one month after the final payment, which requires an additional calculation. (We could have alternatively computed the PV of the annuity, and then computed its future value 46 months in the future.)

Chapter 5

Interest Rates

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. a. Because six months is $\frac{6}{24} = \frac{1}{4}$ of two years, using our rule $(1 + 0.2)^{1/4} = 1.0466$.
So the equivalent six-month rate is 4.66%.
b. Because one year is half of two years $(1.2)^{1/2} = 1.0954$.
So the equivalent one-year rate is 9.54%.
c. Because one month is $1/24$ of two years, using our rule $(1 + 0.2)^{1/24} = 1.00763$.
So the equivalent one-month rate is 0.763%.
2. a. $0.06/12 = 0.005$ or 0.5%
b. $(1.005)^{12} - 1 = 0.0617$ or 6.17%
3. **Plan:** The only way to compare these two rates is to convert them into their effective annual rates (EARs). To compute the EAR, you must first convert to the true rate at the appropriate compounding interval and then compound that rate over one year. The first rate is given as 15% compounded monthly, so you have to first compute the true monthly rate. The second rate is already given as a six-month rate (8% every six months), so you just have to compound it to get the EAR:

Execute:

$$r = \frac{\text{APR}}{\text{compounding periods}} = \frac{0.15}{12} = 0.0125 \quad \text{EAR} = (1.0125)^{12} - 1 = 0.16075$$

$$r = 0.08, \text{ compounding periods} = 2 \quad \text{EAR} = (1.08)^2 - 1 = 0.1664$$

Evaluate:

You should use your credit card because the effective annual rate is lower.

- 4. Plan:** Because the interest rates are quoted over different intervals, the only way to compare them is to compute the interest over a common interval. Here, the natural common interval to choose is three years.

Execute:

If you deposit \$1 into a bank account that pays 5% per year for three years, you will have $(1.05)^3 = 1.15763$ after three years.

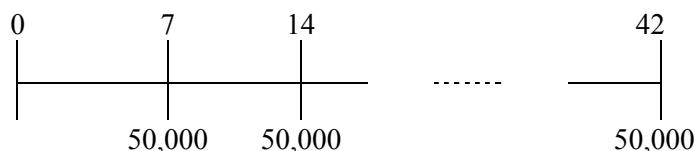
- If the account pays 2 1/2% per six months, then you will have $(1.025)^6 = 1.15969$ after three years, so you prefer 2 1/2% every six months.
- If the account pays 7 1/2% per 18 months, then you will have $(1.075)^2 = 1.15563$ after three years, so you prefer 5% per year.
- If the account pays 1/2% per month then you will have $(1.005)^{36} = 1.19668$ after three years, so you prefer 1/2% every month.

Evaluate:

The comparisons are very difficult to make unless you put them on an equal footing (common interval). Once you do so, the better choice becomes clear.

- *5. Plan:** Draw a timeline to fully understand the timing of the cash flows. Determine the present value of the bonus payments.

Execute:



Because $1.08^6 = 1.8509$, the equivalent discount rate for a 6-year period is 85.09%.

Using the annuity formula

$$PV = 50,000 \left(\frac{1 - \left(\frac{1}{(1.8509)^8} \right)}{1.8509} \right) = \$26,817.76$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	8	85.09%		50,000	0	
Solve for PV:			(26817.76)			=PV(0.8509,8,50000,0)

Evaluate: The PV of the annuity is \$26,817.76.

6. Plan: Determine the EAR for each investment option.

Execute: For \$1 invested in an account with 10% APR with monthly compounding you will have

$$\left(1 + \frac{0.1}{12}\right)^{12} = \$1.10471.$$

So the EAR is 10.471%.

For \$1 invested in an account with 10% APR with annual compounding, you will have $(1 + 0.1) = \$1.10$.

So the EAR is 10%.

For \$1 invested in an account with 9% APR with daily compounding, you will have

$$\left(1 + \frac{0.09}{365}\right)^{365} = 1.09416.$$

So the EAR is 9.416%.

Evaluate: One dollar invested at 10% APR compounded monthly will grow to \$1.10471 in one year. This is greater than the values for the other two investments and, therefore, is superior.

7. Plan: Use the formula for converting from an EAR to an APR quote (Eq. 5.3).

$$\left(1 + \frac{\text{APR}}{k}\right)^k = 1.05$$

Execute:

Solving for the APR

$$\text{APR} = \left[(1.05)^{1/k} - 1\right]k$$

With annual payments $k = 1$, so $\text{APR} = 5\%$.

With semiannual payments $k = 2$, so $\text{APR} = 4.939\%$.

With monthly payments $k = 12$, so $\text{APR} = 4.889\%$.

Evaluate:

The same effective annual rate can be quoted many different ways using different compounding periods.

8. Plan: Determine the present value of the annuity.

Execute: Using the PV of an annuity formula with $N = 30$ payments and $C = \$500$ with $r = 4.06\%$ per 4-month interval because there is a 12% APR with monthly compounding: $12\%/12 = 1\%$ per month, or $(1.01)^4 - 1 = 4.06\%$ per four months.

$$PV = 500 \times \left(\frac{1 - \frac{1}{(1 + 4.06\%)^{30}}}{4.06\%} \right)$$

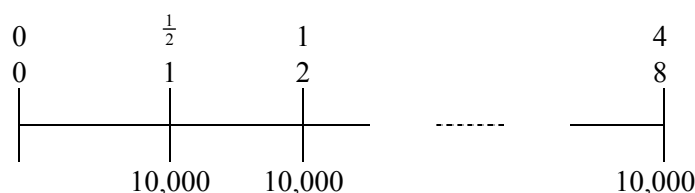
$$= \$8,583.38$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	30	4.06%		500	0	
Solve for PV:			(8583.38)			=PV(0.0406,30,500,0)

Evaluate: The PV of the annuity is \$8583.38.

9. The fee is just an interest payment. If you pay \$30 for a \$200 loan, that's $\$30/\$200 = 15\%$ interest FOR TWO WEEKS! So your effective annual interest rate for this loan compounds the 15% over the 26 two-week periods in the year: $(1.15)^{26} - 1 = 36.8568$, or 3,685.68% !!
10. **Plan:** Draw a timeline to demonstrate when the tuition payments will be needed. Then calculate the PV of the tuition payments.

Execute:



Four percent APR (semiannual) implies a semiannual discount rate of $\frac{4\%}{2} = 2\%$.

So,

$$PV = \frac{10,000}{0.02} \left(1 - \frac{1}{(1.02)^8} \right)$$

$$= \$73,254.81$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	8	2.000%		10000	0	
Solve for PV:			(73,254.81)			=PV(0.02,8,10000,0)

Evaluate: You will have to deposit \$73,254.81 in the bank today in order to be able to make the tuition payments over the next four years.

- 11. Plan:** Compute the discount rate from the APR formula.

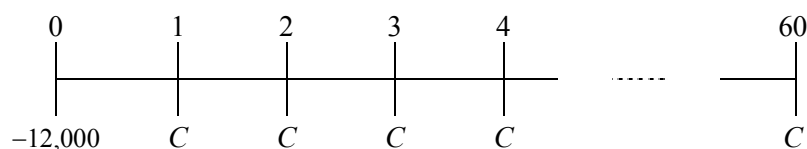
Execute: Using the formula for computing the discount rate from an APR quote:

$$\text{Discount Rate} = \frac{8}{4} = 2\% \text{ per month.}$$

Evaluate: The interest rate is 2% per month.

- 12. Plan:** Draw a timeline for the cash flows. Given that \$12,000 is the present value of an annuity of payments, determine the amount of the payments.

Execute:



6% APR monthly implies a discount rate of $6\% / 12 = 0.5\%$

Using the formula for computing a loan payment

$$12,000 = C \times \frac{1 - \frac{1}{(1 + 0.5\%)^{20}}}{0.5\%}$$

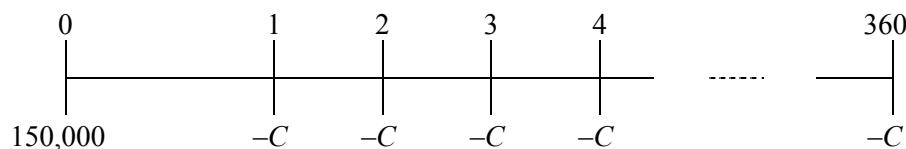
$$= 632$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20	0.5%	12000		0	
Solve for PMT:				(632)		=PMT(0.005,20,12000,0)

Evaluate: Your monthly payment for the motorcycle loan is \$154.63.

- 13. Plan:** Draw a timeline to better understand when the cash flows are occurring. Because \$150,000 is the present value of an annuity of mortgage payments, determine the amount of the mortgage payments.

Execute:



The monthly interest rate is: $(1.068)^{1/12} - 1 = 0.5497367\%$

Solve for the annuity payments that give the PV of the mortgage (150,000).

$$C = \frac{150,000}{\frac{1}{0.005497367} \left(1 - \frac{1}{(1.005497367)^{360}} \right)} = \$957.66$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	0.550%	150,000.00		0	
Solve for PMT:				(957.68)		=PMT(0.005497367,360,150000,0)

Evaluate: The monthly mortgage payment is \$957.66.

- 14. Plan: Plan:** First, compute the payments. Because the payments are monthly, you need the monthly interest rate. An APR of 12%, compounded monthly is a monthly rate of $0.12/12 = 0.01$, or a percent per month. You can use Eq. 4.9 to calculate the loan payment. We can break that payment into the interest (principal of the loan \times the interest rate) and the remainder, which reduces the principal.

Execute:

$$20000 = \frac{PMT}{0.01} \left[1 - \frac{1}{(1 + 0.01)^{96}} \right]$$

$$PMT = \frac{(28000)(0.01)}{\left[1 - \frac{1}{(1 + 0.01)^{96}} \right]} = 455.08$$

The interest in the first month will be the \$28,000 borrowed multiplied by 1% per month: $(28,000)(0.01) = \$280$. So, of your first payment of \$455.08, \$280 will go toward interest and \$175.08 will go toward principal.

Evaluate:

Typically, early in loans, much of the payment goes toward interest, but as the principal decreases and the payments stay the same, more and more of each payment goes toward principal.



- *15. Plan:** Determine the present value of the savings on mortgage payments and the additional principal paid you would make by paying the point. Compare that to the cost of the point.

Execute: First, solve for the monthly mortgage payment at 6.5% APR. The 6.5% APR implies a monthly rate of

$$\frac{6.5\%}{12} = 0.541667\%$$

$$C = \frac{400,000}{\frac{1}{0.00541667} \left(1 - \frac{1}{(1.00541667)^{360}} \right)} = \$2,528.27.$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	0.542%	400,000.00		0	
Solve for PMT:				(2,528.27)		=PMT(0.065/12,360,400000,0)

Next, solve for the monthly mortgage payment at 6.25% APR. The 6.25% APR implies a monthly rate of

$$\frac{6.25\%}{12} = 0.520833\%$$

$$C = \frac{400,000}{\frac{1}{0.00520833} \left(1 - \frac{1}{(1.00520833)^{360}} \right)} = \$2,462.87.$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	0.521%	400,000.00		0	
Solve for PMT:				(2,462.87)		=PMT(0.06525/12,360,400000,0)

So the lower interest rate on the mortgage results in a savings of \$65.40 each month. If we know that we will stay in the house at least five years, is this monthly savings worth the initial cost of \$4,000? Solve for the PV of the mortgage payments, using the 6.25% APR as the interest rate (because this is the opportunity cost of the money):

$$PV_{\text{benefits}} = \frac{65.40}{0.00520833} \left(1 - \frac{1}{(1.00520833)^{60}} \right) = 3,362.60$$

$$NPV = PV_{\text{benefits}} - PV_{\text{costs}}$$

$$NPV = 3362.60 - 4000 = -637.40.$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	60	0.521%		65.4	0	
Solve for PV:			(3,362.60)			=PV(0.005208333333333333,60,65.4,0)

Balance of the 6.5% loan at the end of five years (with 300 payments remaining):

$$PV = \frac{2,528.27}{0.00541667} \left[1 - \frac{1}{(1.00541667)^{300}} \right] = 374,443.46$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	60	0.541667%	(400,000)	2528.27		
Solve for PV:					374,444.15	=FV(0.065/12,60,2528.27,-400000)

Balance of the 6.25% loan at the end of five years (with 300 payments remaining):

$$PV = \frac{2,462.87}{0.00520833} \left[1 - \frac{1}{(1.00520833)^{300}} \right] = 373,349.30$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	60	0.520833%	(400,000)	2462.87		
Solve for PV:					373348.79	=FV(.0625/12,60,2462.87,-400000)

Difference in principal = 374,444.15 – 373,348.79 = 1,094.17

$$PV = \frac{1,094.17}{(1.00520833)^{60}} = 801.16$$

PV(benefits) = 3,362.60 + 801.16 = 4,163.76

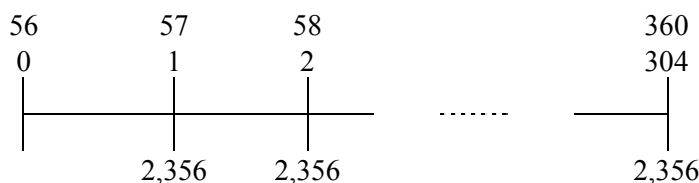
Cost = 4,000

Net = 4,163.76 – 4,000 = 163.76

Evaluate: The net is positive; therefore, you should pay the point. The small net benefit shows that the decision is sensitive to how long you will be in the house—if you move in less than five years, you will not have benefited enough to offset the \$4,000 cost.

- 16. Plan:** Draw a timeline to better understand the timing and amounts of the cash flows. Calculate the loan balance after four years and eight months of payments.

Execute:



To find out what is owed, compute the PV of the remaining payments using the loan interest rate to compute the discount rate:

$$\text{Discount Rate} = \frac{6.375}{12} = 0.53125\%$$

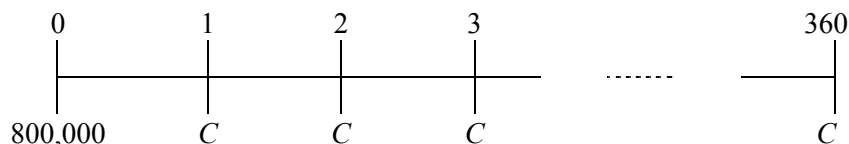
$$PV = \frac{2,356}{0.0053125} \left(1 - \frac{1}{(1.0053125)^{304}} \right) = \$354,900$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	304	0.531%		2356	0	
Solve for PV:			(354,899.99)			=PV(0.0053125,304,2356,0)

Evaluate: You would owe \$354,900 on the mortgage at the end of four years and eight months.

- *17. Plan:** Compute the original loan payment. Then determine how much you owe to the bank at the end of 18 years.

First, we need to compute the original loan payment.



Execute: $5\frac{1}{4}\%$ APR (monthly) implies a discount rate of $\frac{5.25}{12} = 0.4375\%$.

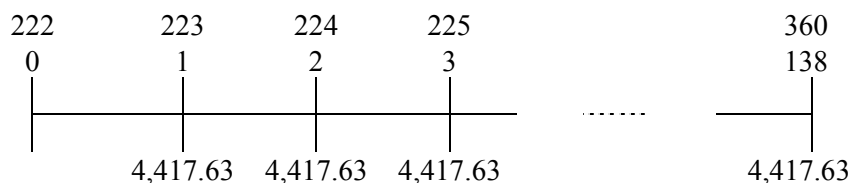
Using the formula for a loan payment

$$C = \frac{800,000 \times 0.004375}{\left(1 - \frac{1}{(1.004375)^{360}}\right)} = \$4,417.63$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	0.438%	800,000.00		0	
Solve for PMT:				(4,417.63)		=PMT(0.004375,360,800000,0)

Now we can compute the PV of continuing to make these payments.

The timeline is:



Using the formula for the PV of an annuity

$$PV = \frac{4,417.63}{0.004375} \left(1 - \frac{1}{(1.004375)^{138}}\right) = \$456,931.41$$

So, you would keep $\$1,000,000 - \$456,931 = \$543,069$.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	138	0.438%		4,417.63	0	
Solve for PV:			(456,931.45)			=PV(0.004375,138,4417.63,0)

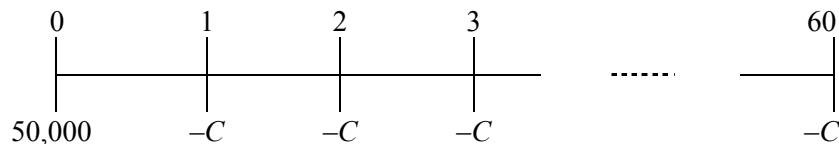
Evaluate: You would keep \$543,069 from the sale of the home.



18. Plan: Draw a timeline and compute the sums that are indicated.

Execute:

a. Timeline:



First, solve for the monthly mortgage payment at 6% APR. The 6% APR implies a monthly rate of $\frac{6\%}{12} = 0.50\%$.

$$C = \frac{50,000}{\frac{1}{0.005} \left(1 - \frac{1}{(1.005)^{60}} \right)} = \$966.64$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	60	0.500%	50,000.00		0	
Solve for PMT:				(966.64)		=PMT(0.005,60,50000,0)

Each monthly payment is \$966.64. After one month, the balance (principal) of the loan will be the PV of the 59 remaining payments.

$$PV = \frac{966.64}{0.005} \left(1 - \frac{1}{(1.005)^{59}} \right) = \$49,283.36$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	59	0.500%		966.64	0	
Solve for PV:			(49,283.36)			=PV(0.005,59,966.64,0)

$50,000 - 49,283.36 = 716.64$ is amount of the payment that went to paying the principal, while $966.64 - 716.64 = 250$ was interest.

For the second month, solve for the value of the remaining 58 payments:

$$PV = \frac{966.64}{0.005} \left(1 - \frac{1}{(1.005)^{58}} \right) = \$48,563.14$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	58	0.500%		966.64	0	
Solve for PV:			(48,563.13)			=PV(0.005,58,966.64,0)

$49,283.36 - 48,563.14 = 720.22$ is the amount of the payment that went to paying the principal, while $966.64 - 720.22 = 246.42$ was interest.

For the first year, solve for the value of the remaining 48 payments:

$$\begin{aligned} PV &= \frac{966.64}{0.005} \left(1 - \frac{1}{(1.005)^{48}} \right) \\ &= \$41,159.84 \end{aligned}$$

$50,000 - 41,159.84 = 8,840.16$ is amount of the payment that went to paying the principal, while $(966.64 \times 12) - 8,840.16 = 2,759.52$ was interest.

- b. At the end of year 3, there are 24 payments remaining. The balance of the loan is:

$$\begin{aligned} PV &= \frac{966.64}{0.005} \left(1 - \frac{1}{(1.005)^{24}} \right) \\ &= \$21,810.17 \end{aligned}$$


At the end of year 4, there are only 12 payments remaining. The balance of the loan at the end of the four year is:

$$\begin{aligned} PV &= \frac{966.64}{0.005} \left(1 - \frac{1}{(1.005)^{12}} \right) \\ &= \$11,231.33 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	12	0.500%		966.64	0	
Solve for PV:			(11,231.33)			=PV(0.005,12,966.64,0)

$21,810.17 - 11,231.33 = 10,578.86$ is amount of the payment that went to paying the principal, while $(966.64 \times 12) - 10,578.86 = 1,020.82$ was interest.

Evaluate: A financial analyst can determine the amount of any loan payment. The financial analyst can also determine the outstanding amount on the loan at any time over its life.

-  **19. Plan:** You can think of a lease as a loan with a balloon payment at the end (when you return the car or give them the residual value). The CF timeline is:

0	1 ...	36
+30,000	-PMT ...	-PMT
		-15,000

First, get the present value of the residual value of the car (you will give them \$15,000 to keep the car or instead give them the car, which they agree to assign a value of \$15,000). Subtract this from the price of the car, and what is left is what you have to cover with your annuity of payments.

Execute:

$$PV = \frac{15,000}{1.005^{36}} = 12,534.67 \quad 30,000 - 12,534.67 = 17,465.33$$

$$17,465.33 = \frac{CF}{.005} \left[1 - \frac{1}{(1.005)^{36}} \right]$$

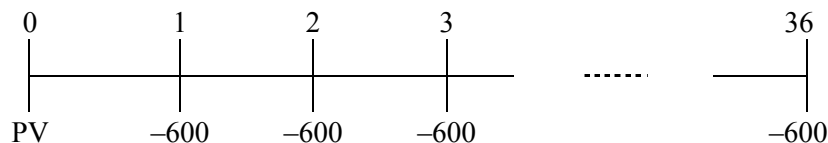
$$CF = 531.33$$

Evaluate:

Your lease payment will be \$531.33, which is less than it would be if you were buying the car with a three-year loan. Lease payments reduce the monthly cost of using the car, but at the end of the lease, you do not own the car.



***20. Plan:** Draw a timeline to better understand the timing and amount of the cash flows. Then determine how much faster the loan would be paid off with a one-time additional \$1,000 payment.



First, calculate the remaining balance on the loan, which is the PV of the remaining payments on the loan.

Execute: The 7% APR implies a monthly rate of

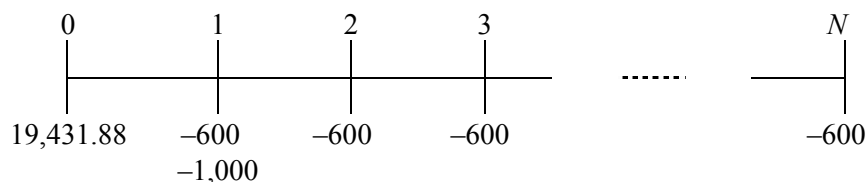
$$\frac{7\%}{12} = 0.58333\%$$

$$PV = \frac{600}{0.0058333} \left(1 - \frac{1}{(1.0058333)^{36}} \right)$$

$$= \$19,431.88$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	36	0.583%		600	0	
Solve for PV:			(19,431.88)			=PV(0.0058333333333333,36,600,0)

If you plan on paying an additional \$1,000 next month, the timeline changes to this:



We want to know how long the payments will last if you include an additional \$1,000 in next month's payment. The principal of the loan must equal the PV of the payments made on the loan, so we can solve for the remaining length of time on the loan:

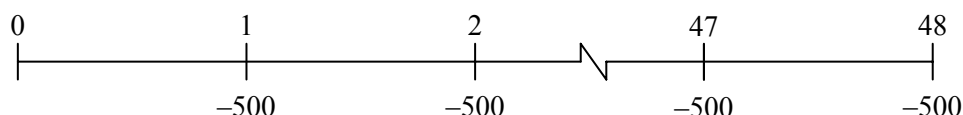
$$\begin{aligned}
 19,431.88 &= \frac{600}{0.0058333} \left(1 - \frac{1}{(1.0058333)^N} \right) + \frac{1,000}{1.0058333} \\
 18,437.68 &= \frac{600}{0.0058333} \left(1 - \frac{1}{(1.0058333)^N} \right) \\
 0.179254 &= 1 - \frac{1}{(1.0058333)^N} \\
 \frac{1}{(1.0058333)^N} &= 1 - 0.179254 = 0.820746 \\
 1.0058333^N &= 1.218404 \\
 N &= \frac{\log(1.218404)}{\log(1.0058333)} \\
 &= 33.96
 \end{aligned}$$

Evaluate: Thus, you reduce the amount of time remaining on the loan by slightly more than two months (from 36 to 34).



***21. Plan:** Draw a timeline to better understand the timing and amount of the cash flows. Then determine how much a one-time additional \$100 payment today will reduce your last payment.

Execute: We begin with the timeline of our required payments.



Let's compute our remaining balance on the student loan. As we pointed out earlier, the remaining balance equals the present value of the remaining payments. The loan interest rate is 9% APR, or $9\%/12 = 0.75\%$ per month, so the present value of the payments is:

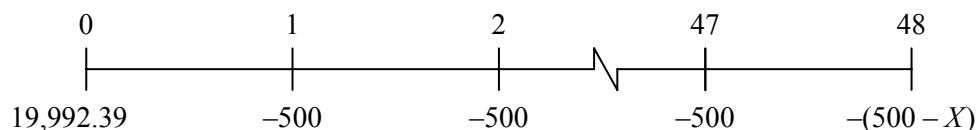
$$\begin{aligned}
 PV &= \frac{500}{0.0075} \left(1 - \frac{1}{1.0075^{48}} \right) \\
 &= \$20,092.39
 \end{aligned}$$

Using the annuity spreadsheet to compute the present value, we get the same number:

N	I/Y	PV	PMT	FV
48	0.75%	20,092.39	-500	0

Thus, your remaining balance is \$20,092.39.

If you prepay an extra \$100 today, you will lower your remaining balance to $\$20,092.39 - 100 = \$19,992.39$. Though your balance is reduced, your required monthly payment does not change. Instead, you will pay off the loan faster; that is, it will reduce the payments you need to make at the very end of the loan. How much smaller will the final payment be? With the extra payment, the timeline changes:



That is, we will pay off by paying \$500 per month for 47 months, and some smaller amount, $\$500 - X$, in the last month. To solve for X , recall that the PV of the remaining cash flows equals the outstanding balance when the loan interest rate is used as the discount rate:

$$19,992.39 = \frac{500}{0.0075} \left(1 - \frac{1}{(1 + 0.0075)^{48}} \right) - \frac{X}{1.0075^{48}}$$

Solving for X gives

$$19,992.39 = 20,092.39 - \frac{X}{1.0075^{48}}$$

$$X = \$143.14$$

So the final payment will be lower by \$143.14.

You can also use the annuity spreadsheet to determine this solution. If you prepay \$100 today, and make payments of \$500 for 48 months, then your final balance at the end will be a credit of \$143.14:

N	I/Y	PV	PMT	FV
48	0.75%	19,992.39	-500	143.14

The extra payment effectively lets us exchange \$100 today for \$143.14 in four years. We claimed that the return on this investment should be the loan interest rate. Let's see if this is the case:

$$\$100 \times (1.0075)^{48} = \$143.14, \text{ so it is.}$$

Thus, you earn a 9% APR (the rate on the loan).

Evaluate: Your last payment will be reduced by \$143.14.



***22. Plan:** Draw a timeline to better understand the timing and amount of the cash flows. Then determine how much faster the loan would be paid off if you increase each additional payment by \$250.



And we want to determine the number of monthly payments N that we will need to make. That is, we need to determine what length an annuity with a monthly payment of \$750 has the same present value as the loan balance, using the loan interest rate as the discount rate. As we did in Chapter 4, we set the outstanding balance equal to the present value of the loan payments and solve for N .

Execute:

$$\begin{aligned} \frac{750}{0.0075} \left(1 - \frac{1}{1.0075^N} \right) &= 20,092.39 \\ \left(1 - \frac{1}{1.0075^N} \right) &= \frac{20,092.39 \times 0.0075}{750} = 0.200924 \\ \frac{1}{1.0075^N} &= 1 - 0.200924 = 0.799076 \\ 1.0075^N &= 1.25145 \\ N &= \frac{\text{Log}(1.25145)}{\text{Log}(1.0075)} = 30.02 \end{aligned}$$

We can also use the annuity spreadsheet to solve for N :

N	I/Y	PV	PMT	FV
30.02	0.75%	20,092.39	-750	0

Evaluate: So, by prepaying the loan, we will pay off the loan in about 30 months or 2 ½ years, rather than the four years originally scheduled. Because N of 30.02 is larger than 30, we could either increase the 30th payment by a small amount or make a very small 31st payment. We can use the annuity spreadsheet to determine the remaining balance after 30 payments:

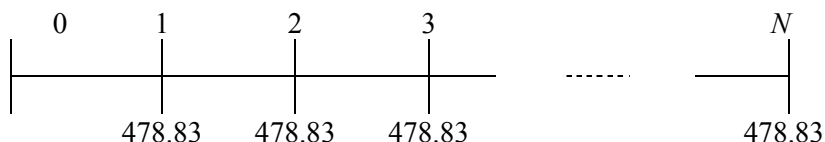
N	I/Y	PV	PMT	FV
30	0.75%	20,092.39	-750	-13.86

If we make a final payment of $\$750.00 + \$13.87 = \$763.87$, the loan will be paid off in 30 months.



***23. Plan:** Draw a timeline to determine the amount and timing of the cash flows. Then determine how much more quickly the loan would be paid off with payments made every two weeks versus every month.

Evaluate: From the solution to Problem 5.11, the monthly payment on the mortgage is \$957.66. So if we make $\frac{957.66}{2} = \$478.83$ every two weeks the timeline is:



Now because there are 26 weeks in a year

$$(1.0680)^{1/26} = 1.0025335$$

So, the discount rate is 0.25335%.

To compute N we set the PV of the loan payments equal to the outstanding balance

$$150,000 = \frac{478.83}{0.0025335} \left(1 - \frac{1}{(1.0025335)^N} \right)$$

And solve for N

$$1 - \left(\frac{1}{1.0025335} \right)^N = \frac{150,000 \times 0.0025335}{478.86} = 0.793604$$

$$\left(\frac{1}{1.0025335} \right)^N = 0.206396$$

$$N = \frac{\log(0.206396)}{\log\left(\frac{1}{1.0025335}\right)} = 623.63$$

	N	I/Y	PV	PMT	FV	Excel Formula
	0.0	478.8	150,00			
Given:	0.253%	0	3	0		
Solve for NPER:	-623.72					=NPER(0.00253350161796617,478.83,0,150000)

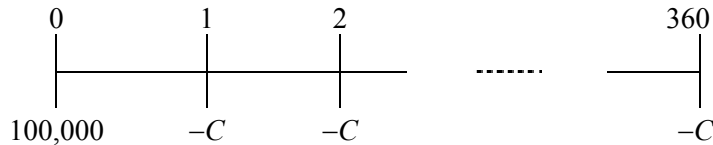
Evaluate: So it will take 624 payments to pay off the mortgage. Because the payments occur every two weeks, this will take $624 \times 2 = 1,248$ weeks, or approximately 24 years. (It is shorter because there are approximately two extra payments every year.)



***24. Plan:** Draw a timeline to determine the amount and timing of the cash flows. Then determine how much more quickly the loan would be paid off with a double payment made January 1.

Execute: The principal balance does not matter, so just pick 100,000. Begin by computing the monthly payment. The discount rate is $12\%/12 = 1\%$.

Timeline #1:



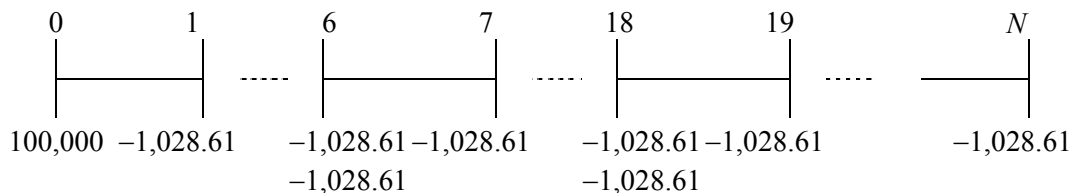
Execute: Using the formula for the loan payment

$$C = \frac{100,000 \times 0.01}{\left(1 - \frac{1}{1.01^{360}}\right)} = \$1,028.61$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	1.000%	100,000.00		0	
Solve for PMT:				(1,028.61)		=PMT(0.01,360,100000,0)

Next we write out the cash flows with the extra payment:

Timeline #2:



The cash flow consists of two annuities.

- a. The original payments. The PV of these payments is:

$$PV_{\text{org}} = \frac{1,028.61}{0.01} \left(1 - \left(\frac{1}{1.01}\right)^N\right)$$

- b. The extra payment is every Christmas. There are m such payments, where m is the number of years you keep the loan. (For the moment we will not worry about the possibility that m is not a whole number.) Because the time period between payments is one year, we first have to compute the discount rate

$$(1.01)^{12} = 1.12683.$$

So the discount rate is 12.683%.

Now the present value of the extra payments in month 6 consists of the remaining $m - 1$ payments (an annuity) and the payment in month 6. So the PV is:

$$PV_6 = \frac{1028.61}{0.12683} \left(1 - \frac{1}{(1.12683)^{m-1}} \right) + 1028.61$$

To get the value today, we must discount these cash flows to month zero. Recall that the monthly discount rate is 1%. So the value today of the extra payment is:

$$PV_{\text{extra}} = \frac{PV_6}{(1.01)^6} = \frac{1028.61}{0.12683(1.01)^6} \left(1 - \frac{1}{(1.12683)^{m-1}} \right) + \frac{1028.61}{(1.01)^6}$$

To find out how long it will take to repay the loan, we need to determine the number of years until the value of our loan payments has a present value at the loan rate equal to the amount we borrowed. Because the number of monthly payments $N = 12 \times m$, we can write this as the following expression which we need to solve for m :

$$\begin{aligned} 100,000 &= PV_{\text{org}} + PV_{\text{extra}} \\ 100,000 &= \frac{1,028.61}{0.01} \left(1 - \left(\frac{1}{1.01} \right)^{12m} \right) \\ &\quad + \frac{1,028.61}{0.12683(1.01)^6} \left(1 - \frac{1}{(1.12683)^{m-1}} \right) + \frac{1,028.61}{(1.01)^6} \end{aligned}$$

The only way to find m is to iterate (guess). The answer is $m = 19.04$ years, or approximately 19 years. In fact, after exactly 19 years, the PV of the payment is:

$$\begin{aligned} PV &= \frac{1,028.61}{0.01} \left(1 - \left(\frac{1}{1.01} \right)^{228} \right) + \frac{1028.61}{0.12683(1.01)^6} \left(1 - \frac{1}{(1.12683)^{18}} \right) + \frac{1,028.61}{(1.01)^6} \\ &= \$99,939 \end{aligned}$$

Because you initially borrowed \$100,000, the PV of what you still owe at the end of 19 years is $\$100,000 - \$99,939 = \$61$. The future value of this in 19 years and 1 month is:

$$61 \times (1.01)^{229} = \$596$$

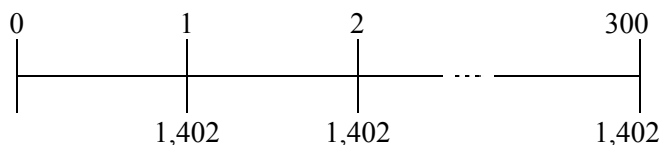
Evaluate: So you will have a partial payment of \$596 in the first month of the 19th year. Because the mortgage will take about 19 years to pay off this way—which is close to 2/3 of its life of 30 years—your friend is right.

**25. Plan:**

- a. First we deal with analyzing the existing mortgage, and analyzing several other financing alternatives.

Execute: First, we calculate the outstanding balance of the mortgage. There are $25 \times 12 = 300$ months remaining on the loan, so the timeline is as follows.

Timeline 1:



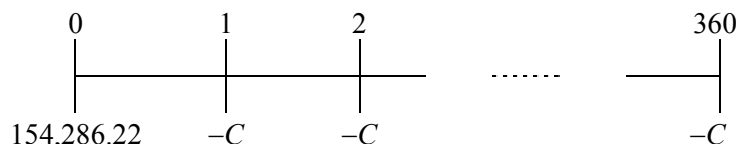
To determine the outstanding balance, we discount at the original rate, i.e., $\frac{10}{12} = 0.8333\%$.

$$\begin{aligned} PV &= \frac{1,402}{0.008333} \left(1 - \frac{1}{(1.008333)^{300}} \right) \\ &= \$154,286.22 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	300	0.833%		1402	0	
Solve for PV:			(154,286.22)			=PV(.10/12,300,1402,0)

Next we calculate the loan payment on the new mortgage.

Timeline 2:



The discount rate on the new loan is the new loan rate: $\frac{6.625}{12} = 0.5521\%$.

Using the formula for the loan payment:

$$\begin{aligned} C &= \frac{154,286.22 \times 0.005521}{\left(1 - \left(\frac{1}{1.005521} \right)^{360} \right)} \\ &= \$987.93 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	360	0.552%	154,286.22		0	
Solve for PMT:				(987.91)		=PMT(.06625/12,360,154286.22,0)

b. $C = \frac{154,286.22 \times 0.005521}{\left(1 - \left(\frac{1}{1.005521} \right)^{300} \right)} = \$1,053.85$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	300	0.552%	154,286.22		0	
Solve for PMT:				(1,053.83)		=PMT(.06625/12,300,154286.22,0)

$$c. \quad PV = \frac{1402}{0.005521} \left(1 - \frac{1}{(1.005521)^N} \right) = \$154,286.22 \Rightarrow N = 170 \text{ months}$$

(You can use trial and error or the annuity calculator to solve for N .)

	N	I/Y	PV	PMT	FV	Excel Formula
Given:		0.552%	0.00	1,402	154,286	
Solve for NPER:	-169.89					=NPER(0.06625/12,1402,0,154286.22)


$$d. \quad PV = \frac{1402}{0.005521} \left(1 - \frac{1}{(1.005521)^{300}} \right) = \$205,255$$

\Rightarrow you can keep $205,259 - 154,286 = \$50,969$

(Note: Results may differ slightly due to rounding. If you don't round at all, the answer will be 205,259, so you could keep 50,973.)

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	300	0.552%		1,402	0	
Solve for PV:			(205,259.23)			=PV(0.06625/12,300,1402,0)

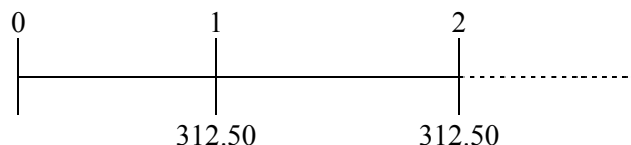
Evaluate: In considering this mortgage refinancing, it is clear that the homeowner has several alternatives that will depend on the amount of monthly payments to be made and how long it will take to pay off the mortgage.

 **26. Plan:** Use a timeline and financial analysis to determine how much more you could borrow at the lower rate and keep the same payments.

Execute: The discount rate on the original card is $\frac{15}{12} = 1.25\%$.

Assuming that your current monthly payment is the interest that accrues, it equals:

$$\$25,000 \times \frac{0.15}{12} = \$312.50$$



This is a perpetuity. So the amount you can borrow at the new interest rate is this cash flow discounted at the new discount rate. The new discount rate is $\frac{12}{12} = 1\%$.

So,

$$\begin{aligned} PV &= \frac{312.50}{0.01} \\ &= \$31,250 \end{aligned}$$

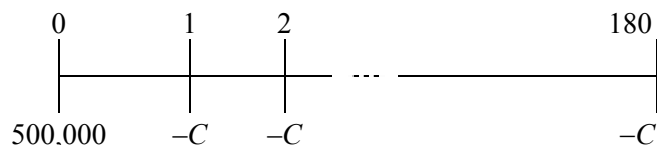
Evaluate: So by switching credit cards you are able to spend an extra $31,250 - 25,000 = \$6,250$. You do not have to pay taxes on this amount of new borrowing, so this is your *after-tax* benefit of switching cards.



- 27. Plan:** Draw a timeline to determine the amount and timing of the cash flows. Then determine how much you would owe at the end of five years.

Execute:

- a. The payments are established as if the loan will last 15 years. Thus, the “timeline” for determining the payments looks like this:

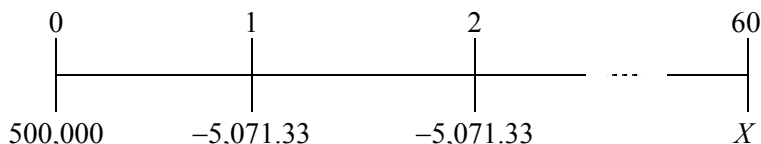


The discount rate is $9\%/12 = 0.75\%$ per month.

$$\begin{aligned} C &= \frac{500,000 \times 0.0075}{\left(1 - \frac{1}{1.0075^{180}}\right)} \\ &= \$5,071.33 \end{aligned}$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	180	0.750%	500,000.00		0	
Solve for PMT:				(5,071.33)		=PMT(0.0075,180,500000,0)

- b. The actual timeline of payments is:



To solve for X , set the PV of the payments equal to \$500,000:

$$\begin{aligned} 500,000 &= \frac{5,071.33}{0.0075} \left(1 - \frac{1}{(1.0075)^{59}}\right) + \frac{X}{1.0075^{60}} 500,000 - 241,064.02 \\ &= 258,935.98 = \frac{X}{1.0075^{60}} \\ X &= 258,935.98 \times 1.0075^{60} \\ &= 405,411.15 \end{aligned}$$

Evaluate: Thus, the final payment on the last month is \$405,411.15.

- *28. a. Your monthly payments are computed as the CF in an annuity:

$$300,000 = \frac{CF}{0.0035} \left[1 - \frac{1}{(1.0035)^{360}} \right], \text{ so } CF = \frac{300,000}{204.4918} = 1,467.05.$$

Note that there is a small rounding difference; answers can differ by about \$0.30.

At any time, the balance is the PV of the remaining payments. There are 300 remaining

payments of 1467.05, so your balance is: $PV = \frac{1,467.05}{0.0035} \left[1 - \frac{1}{(1.0035)^{300}} \right] = 272,209.09$.

Note that using the numbers shown, the answer comes out to 272,209.38. So, there is a small rounding difference.

- b. You still owe \$272,209.09 and you still have 300 remaining payments, but the new interest rate is $0.052/12 = 0.004333$. The new payment can be calculated as:

$$300,000 = \frac{CF}{0.004333} \left[1 - \frac{1}{(1.004333)^{300}} \right], \text{ so } CF = \frac{272,209.09}{167.7133} = 1,623.06.$$

Note that using the numbers shown, the answer comes out to 1,632.19. So, there is a small rounding difference.

29. The real rate of interest is a negative 7.33%.

$$\begin{aligned} r_r &= \frac{r - i}{1 + i} \\ &= \frac{6.85\% - 15.3\%}{1.153} \\ &= -7.33\% \end{aligned}$$

The growth in purchasing power = $1 + \text{real rate} = 1 + (-7.33\%) = 0.9267$. Because of the high rate of inflation, the purchasing power of money invested at 6.85% is actually losing purchasing power.

The purchasing power of your savings declined by 7.33% over the year.

30. If the rate of inflation is 5%, what nominal interest rate is necessary for you to earn a 3% real interest rate on your investment?

$$\begin{aligned} 1 + r_r &= \frac{1 + r}{1 + i} \text{ implies } 1 + r = (1 + r_r)(1 + i) \\ &= (1.02)(1.08) = 1.1016 \end{aligned}$$

Therefore, a nominal rate of 10.16% is required.

31. Plan: To put these on the same basis, you must convert them both to nominal EARs.

Execute: 8% APR, compounded semiannually is $8\%/2 = 4\%$ every 6 months, or $(1.04)^2 - 1 = 0.0816$ per year (nominal rate).

4% APR, compounded quarterly is $0.04/4 = .01$ per quarter or $(1.01)^4 - 1 = .0406$ per year (real rate). With inflation at 5%, compounded annually, that annual real rate corresponds to $(1.0406)(1.05) - 1 = .09263$ per year (nominal), so the real rate of 4%, compounded quarterly, is much better than the nominal rate of 8%, compounded semiannually.

Evaluate: Once you have them both in terms of nominal EARs, you can see which is actually the higher rate.

32. Inflation: $(1.002)^{12} - 1 = 0.024266$

Nominal: $(1.0075)^{12} - 1 = 0.093807$

Real has annual compounding, so $\text{APR} = \text{EAR} = 0.065$

Convert real to nominal: $(1.065)(1.024266) - 1 = 0.0908 < 0.0938$, so you would rather have the nominal 0.0075 (0.75%) per month.

33. Plan: You have to adjust your nominal wage growth by the growth in prices to get your real wage growth.

Execute: $(1.07)/(1.03) - 1 = 0.0388$, or 3.88%

Evaluate: Even though you have 7% more dollars in your paycheck, you can only buy 3.88% more stuff because prices have also increased (by 3%).

34. The yield curve is increasing. This is often a sign that investors expect interest rates to rise in the future.

35. If the bond market were particularly concerned about inflation, it would be reflected in much higher long-term nominal rates (which would have to reflect real rates plus higher future inflation). While long-term rates are certainly higher than short-term rates, they are still quite low by historical standards, so there is not a lot of inflation expectation built in.

36. Plan: Because the investment in your friend's business is risky, the 1% riskless rate from Treasuries is not relevant. The 10% rate you could expect to earn on other similarly risky investments is the correct opportunity cost of capital, so you should discount the expected value of your investment using the 10% rate to see if it is greater than the \$5,000 cost.

Execute: $5,750/(1.10) = 5,227.27$, so the PV of the benefit (discounted at your opportunity cost of capital) exceeds the cost, making it a good investment.

Evaluate:

By recognizing your cost of capital and applying it to the payoffs from the investment, you can make the right decision about whether to invest in your friend's business.

- 37.** This business produces an expected return of $\$300/\$5,000 = 6\%$. If projects that are similar in horizon and risk are offering an expected return of 8%, then this business is not earning your opportunity cost of capital, and you should invest elsewhere.

Chapter 6

Bonds

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

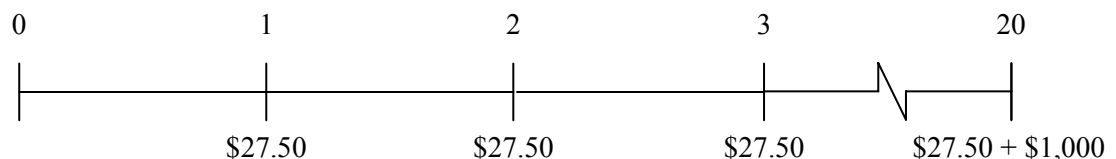
- Plan:** We can use Eq. 6.1 to determine the semiannual coupon payment on the bond and then create a timeline for the cash flows using the semiannual coupon payment found earlier.

Execute:

- The coupon payment is:

$$\begin{aligned}\text{CPN} &= \frac{\text{Coupon Rate} \times \text{Face Value}}{\text{Number of Coupons per Year}} \\ &= \frac{0.055 \times \$1,000}{2} \\ &= \$27.50\end{aligned}$$

- Using the semiannual coupon payment, we can then create a timeline for the cash flows of the bond. The timeline for the cash flows for this bond is (the unit of time on this timeline is six-month periods):



Evaluate: We can compute the coupon payment by simply computing the yearly total coupon payments using the coupon rate and the face value, and then dividing that by the number of coupon payments per year. Also, in order to compute the value of the bond, we need to know the cash flows, and this is why we plot out those cash flows in a timeline.

- Plan:** We can see that the bond consists of an annuity of 40 payments of \$30, paid every six months, and one lump-sum payment of \$1,000 (face value) in 20 years (40 six-month periods). We can rearrange Eq. 6.1 in order to find the coupon rate knowing the coupon payment of \$30. By rearranging Eq. 6.1, we come up with: coupon rate = (coupon payment/face value) × number of coupon payments per year.

Execute:

- a. The maturity is 20 years.
- b. $(30/1000) \times 2 = 6\%$, so the coupon rate is 6%.
- c. The face value is \$1,000.

Evaluate: The maturity of the bond is the final repayment date of that bond, at which point payments on the bond will terminate. In this case, the bond will make 40 semiannual payments terminating in 20 years. We can find the coupon rate if we know the coupon payment, face value, and number of coupon payments per year by using and rearranging Eq. 6.1. Finally, we know that the face value of the bond is the amount repaid at maturity, in this case \$1,000.

3. **Plan:** Zero-coupon bonds are pure discount bonds. They are issued at the present value of their principal (face) value. The PV must be \$10,000,000 in order to raise that much money. Thus, we need to calculate the FV of \$10,000,000 at 6% for 20 years, to determine the necessary face value.

Execute: $FV = \$10,000,000(1.06)^{20} = \$32,071,354.72$.

Evaluate:

Because we are not paying any interim interest payments, we must sell the bonds at a substantial discount to face value. That means that in order to receive \$10 million from the sale, we must offer more than \$32 million in face value.



4. **Plan:** We can use Eq. 6.2 to compute the yield to maturity for each bond. We can then use Excel to plot the zero-coupon yield curve, which will plot the yield to maturity of investments of different maturities using the yield to maturity on the y-axis and the maturity in years on the x-axis.

Execute:

- a. Using Eq. 6.2 for the first five years to compute the yield to maturity:

$$1 + \text{YTM}_n = \left(\frac{FV_n}{P} \right)^{1/n}$$

$$1 + \text{YTM}_1 = \left(\frac{100}{95.51} \right)^{1/1} \Rightarrow \text{YTM}_1 = 4.70\%$$

$$1 + \text{YTM}_1 = \left(\frac{100}{91.05} \right)^{1/2} \Rightarrow \text{YTM}_1 = 4.80\%$$

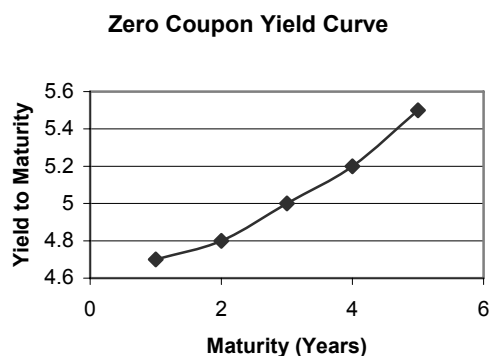
$$1 + \text{YTM}_3 = \left(\frac{100}{86.38} \right)^{1/3} \Rightarrow \text{YTM}_3 = 5.00\%$$

$$1 + \text{YTM}_4 = \left(\frac{100}{81.65} \right)^{1/4} \Rightarrow \text{YTM}_4 = 5.20\%$$

$$1 + \text{YTM}_5 = \left(\frac{100}{76.51} \right)^{1/5} \Rightarrow \text{YTM}_5 = 5.50\%$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	1		-95.51	0	100	
Solve for Rate:		4.70%				=RATE(1,0,-95.51,100)
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	2		-91.05	0	100	
Solve for Rate:		4.80%				=RATE(2,0,-91.05,100)
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	3		-86.38	0	100	
Solve for Rate:		5.00%				=RATE(3,0,-86.38,100)
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4		-81.65	0	100	
Solve for Rate:		5.20%				=RATE(4,0,-81.65,100)
	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5		-76.51	0	100	
Solve for Rate:		5.50%				=RATE(5,0,-76.51,100)

b. The yield curve is:



c. The yield curve is upward sloping.

Evaluate: The yield to maturity of the bond is the discount rate that sets the present value of the promised bond payments equal to the current market price of the bond. We can use Eq. 6.2 knowing the face value, price, and year of each bond in order to find the yield to maturity. We can plot the zero-coupon yield curve using Excel, which will compare the yield to maturity of investments of different maturities.

- 5. Plan:** We can use the bond's yield to maturity to compute the bond's price as the present value of the face amount, where the discount rate is the bond's yield to maturity. From the table, the yield to maturity for 2-year, zero-coupon, risk-free bonds is 8.50%.

Execute: $P = 100/(1.085)^2 = \$84.95$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	2	8.5%		0	100	
Solve for PV:			(84.95)			=PV(0.085,2,0,100)

Evaluate: We can compute the price of a zero-coupon bond simply by computing the present value of the face amount using the bond's yield to maturity.

- 6. Plan:** We can use the bond's yield to maturity to compute the bond's price as the present value of the face amount, where the discount rate is the bond's yield to maturity. From the table, the yield to maturity for four-year, zero-coupon, risk-free bonds is 8.95%.

Execute: $P = 100/(1.0895)^4 = \$70.97$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4	8.950%		0	100	
Solve for PV:			(70.97)			=PV(0.0895,4,0,100)

Evaluate: We can compute the price of a zero-coupon bond simply by computing the present value of the face amount using the bond's yield to maturity.

7. 9.05%.

8. The prices of several bonds with face values of \$1,000 are summarized in the following table:

Bond	A	B	C	D
Price	\$972.50	\$1040.75	\$1150.00	\$1000.00

- 9. Plan:** These are all issued by the same issuer with the same par value. They only differ on the size of the coupon payments and the maturity.

Execute:

- Three-year (you get the FV sooner, so its PV must be higher).
- Four percent coupon bond—the timing is the same, but the 4% coupon bond pays interest payments, while the zero-coupon bond is a pure discount bond.
- Six percent coupon bond—the timing is the same, but the coupon (interest) payments are higher for the 6% bond.

Evaluate:

When the timing is the same, the bond with the higher coupon payments (larger interim cash flows) must be worth more. When the timing is different, but the coupons are zero, the bond that pays off sooner must be worth more.

- 10. Plan:** Given the yield, we can compute the price using Eq. 6.3. First, note that a 7.6% APR is equivalent to a semiannual rate of 3.8%. Also, recall that the cash flows of this bond are an annuity of four payments of \$35, paid every six months, and one lump-sum cash flow of \$1,000 (the face value), paid in two years (four six-month periods).

Execute:

$$PV = \frac{35}{\left(1 + \frac{0.076}{2}\right)} + \frac{35}{\left(1 + \frac{0.076}{2}\right)^2} + \frac{35}{\left(1 + \frac{0.076}{2}\right)^3} + \frac{35 + 1,000}{\left(1 + \frac{0.076}{2}\right)^4}$$

$$PV = 989.06$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4	3.800%		35	1,000	
Solve for PV:			(989.06)			=PV(0.038,4,35,1000)

Evaluate: The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield, we can find the bond's price.

- 11.** First, calculate the cash flows and put them on a timeline. A \$1,000 par, 4% coupon bond pays $(0.04 \times \$1,000)/2 = \20 every six months and then pays the \$1,000 par at maturity. The next payment is due in six months.

Today	6 months	1 year	1.5 years
	20	20	1020

Next, convert the quoted APRs into six-month rates because the cash flows come at six-month intervals. Finally, discount the cash flows.

Execute:

Convert APRs to six-month rates: $0.01/2 = 0.005$; $0.011/2 = 0.0055$; $0.013/2 = 0.0065$.

Discount the cash flows using the appropriate spot rate for each cash flow, remembering that the number of periods (n) refers to the number of six-month periods.

$$PV = \frac{\$20}{(1.005)} + \frac{\$20}{(1.0055)^2} + \frac{\$1,020}{(1.0065)^3} = \$1,040.05$$

Evaluate:

The bond is trading at a premium (price greater than par) because the coupon rate of 4% is higher than the current market spot rates. The price rises until the bond's return matches the return offered elsewhere in the market for cash flows of the same timing and risk.



- 12. Plan:** The bond consists of an annuity of 20 payments of \$40, paid every six months, and one lump-sum payment of \$1,000 in 10 years (20 six-month periods). We can use Eq. (6.3) to solve for the yield to maturity. However, we must use six-month intervals consistently throughout the equation. In addition, we can use an annuity spreadsheet in Excel (shown in each part) to find the bond's yield to maturity. Also, given the yield, we can compute the price using Eq. (6.3). Note that a 9% APR is equivalent to a semiannual rate of 4.5%. Again, we can use a spreadsheet in Excel to find the new price of the bond.

Execute: Using Eq. (6.3) to find the bond's yield to maturity:

$$a. \$1034.74 = \frac{40}{\left(1 + \frac{YTM}{2}\right)} + \frac{40}{\left(1 + \frac{YTM}{2}\right)^2} + \dots + \frac{40 + 1,000}{\left(1 + \frac{YTM}{2}\right)^{20}} \Rightarrow YTM = 7.5\%$$

Using the annuity spreadsheet:

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20		-1,034.74	40	1000	
Solve for Rate:		3.75%				=RATE(20,40,-1034.74,1000)

Therefore, $YTM = 3.75\% \times 2 = 7.50\%$.

$$b. PV = \frac{40}{\left(1 + \frac{0.09}{2}\right)} + \frac{40}{\left(1 + \frac{0.09}{2}\right)^2} + \dots + \frac{40 + 1,000}{\left(1 + \frac{0.09}{2}\right)^{20}} = \$934.96.$$

Using the spreadsheet.

With a 9% $YTM = 4.5\%$ per six months, the new price is \$934.96.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	20	4.50%		40	1,000	
Solve for PV:			(934.96)			=PV(0.045,20,40,1000)

Evaluate: The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield we can find the bond's price. The bond's price has lowered to \$934.96, raising the yield to maturity from 7.50% to 9% APR. The present value of the bond payments equal to the current market price of the bond is lowered by increasing the discount rate of the bond.

- 13. Plan:** We can compute the bond's coupon rate by rearranging Eq. 6.3 to find the coupon payment. We can also use an annuity spreadsheet in Excel to find the coupon rate.

Execute:

$$C[1 - 1/(1.08)^7] / 0.08 + 1,000 / (1.08)^7 = \$930$$

$C = \$66.55$, so the coupon rate is 6.655%.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	7	8.00%	-930.00		1000	
Solve for PMT:				66.55		=PMT(0.08,7,-930,1000)

Therefore, the coupon rate is 6.655%.

Evaluate: In order to compute the coupon rate, you must know the coupon payment. In this case, we can solve for the coupon payment by rearranging Eq. 6.3 to find the annual coupon payment and then dividing that number by the face value in order to convert the annual payment into the coupon rate.

- 14.** Two percent coupon means 2% of \$1,000, or \$20, paid out in six-month installments of \$10 each. The bond matures in one year and pays its par back at that time. So, the cash flows are \$10 in six months and \$1,010 in one year. The appropriate rate for the six-month cash flow is 1.6% APR, compounded semiannually, or 0.8% (0.008) per six-month period. The appropriate rate for the one-year cash flow is 2% APR, or 1% (0.01) every six months, compounded over two six month periods ($n = 2$):

$$\text{Price} = PV = \frac{10}{(1.008)} + \frac{1,010}{(1.01)^2} = 1,000.02$$


- 15.** a. discount
b. at par
c. premium
d. premium
- 16.** The bond's price will go down. Mathematically, the discount rate will increase, so the PV must decrease. Economically, the market interest rates represent the opportunity cost of capital. When your other investment opportunities become more attractive, this one becomes relatively less attractive, so its price must decrease until market participants are willing to buy it.
- 17. Plan:** Given the increase in the bond's yield to maturity, we can compute the price using Eq. 6.3. First, note that a 9% APR is equivalent to a semiannual rate of 4.5%. Also, recall that the cash flows of this bond are an annuity of 10 payments of \$50, paid every six months, and one lump-sum cash flow of \$1,000 (the face value), paid in five years (ten six-month periods).

Execute:

- a. Because the yield to maturity is less than the coupon rate, the bond is trading at a premium.
b. $50[1 - 1/(1.045)^{10}] / 0.045 + 1,000 / (1.045)^{10} = \$1,039.56$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	4.50%		50	1000	
Solve for PV:			(1039.56)			=PV(0.045,10,50,1000)

Evaluate The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield, we can find the bond's price. The bond's price has lowered to \$1,039.56, raising the yield to maturity from 8.5% to 9.00% APR. The present value of the bond payments equal to the current market price of the bond is lowered by increasing the discount rate of the bond.

-  **18. Plan:** Given the bond's yield to maturity, we can compute the price using Eq. 6.3. Note that the cash flows of this bond are an annuity of 10 payments of \$70, paid annually, and one lump-sum cash flow of \$1,000 (the face value), paid in 10 years.


Execute: When it was issued, the price of the bond was:

$$P = \frac{70}{(1 + 0.06)} + \dots + \frac{70 + 1,000}{(1 + 0.06)^{10}}$$

$$= \$1,073.60.$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	6.000%		70	1,000	
Solve for PV:			(1,073.60)			=PV(0.06,10,70,1000)

Evaluate: The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield, we can find the bond's price, which is \$1,073.60.

-  **19. Plan:** Because we are valuing the bond just before the first \$70 coupon payment, we know that the payment is worth \$70. The rest of the bond is now a nine-year bond, which we can value. The value of the bond is the sum of these cash flows.

Execute: Before the first coupon payment, the price of the bond is:

$$P = 70 + \frac{70}{(1 + 0.06)} + \dots + \frac{70 + 1,000}{(1 + 0.06)^9}$$

$$= \$1,138.02.$$

Evaluate: This bond would have a value of \$1,138.02.



- 20. Plan:** Because the first \$70 coupon has just been paid, it no longer is reflected in the value of the bond. The bond is now a nine-year maturity bond, which can be valued.

Execute: After the first coupon payment, the price of the bond will be

$$P = \frac{70}{(1+0.06)} + \dots + \frac{70+1,000}{(1+0.06)^9} = \$1,068.02.$$

Evaluate: The value of this bond is \$1,068.02.

- 21. Plan:** A 6% coupon bond pays $(0.06 \times \$1,000)/2 = \30 every six months.

We can use the fact that there are 20 six-month periods left until maturity and Eq 6.3 to infer the YTM for the existing bond. Your company will have to offer a coupon rate equal to that YTM to sell new bonds.

Execute:

$$\$1,078 = \$30 \times \frac{1}{y} \left(1 - \frac{1}{(1+y)^{20}} \right) + \frac{1,000}{(1+y)^{20}}$$

Using either trial and error, a financial calculator, or Excel, we can determine that $y = 0.025$.

N	I/Y	PV	PMT	FV
20	0.025	-1078	30	1000

Excel Formula: = RATE(NPER,PMT,PV,FV) = RATE(20,30, -1078,1000)

The Six-month rate is 0.025, so the semiannually compounded APR would be 5% ($2.5\% \times 2$). Because the market is currently pricing your company's bonds to yield 5%, you would need to offer a 5% coupon rate in order to have them priced at par.

Evaluate:

Even though you had to offer a 6% coupon rate in the past, market conditions have changed and the coupon rate you would now have to offer would only be 5%.

- 22. Plan:** We can use a financial calculator or Excel to compute the initial price of the bond using 10 annual coupon payments, 5% yield to maturity, \$6 coupon payment, and \$100 future value to solve for the present value, which is the cash outflow in year zero. Next, we can use a financial calculator or Excel to compute the price that the bond sold at using only six years to maturity (annual coupon payments), 5% yield to maturity, \$6 coupon payment, and \$100 future value to solve for the present value, which is part of the cash flow in year 4 along with the \$6 coupon payment (\$1,000 face value \times 6% coupon rate = \$6 coupon payment). In order to compute the IRR, we can use the annuity spreadsheet in Excel using the purchase price as the present value, the \$6 coupon payment, the sales price as the future value, and four years for the length of the investment.

Execute:

- a. First, we compute the initial price of the bond by discounting its 10 annual coupons of \$6 and final face value of \$100 at the 5% yield to maturity:

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	5.00%		6	100	
Solve for PV:			(107.72)			=PV(0.05,10,6,100)

Thus, the initial price of the bond = \$107.72. (Note that the bond trades above par, as its coupon rate exceeds its yield.)

Next, we compute the price at which the bond is sold, which is the present value of the bond's cash flows when only six years remain until maturity:

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	6	5.00%		6	100	
Solve for PV:			(105.08)			=PV(0.05,6,6,100)


Therefore, the bond was sold for a price of \$105.08. The cash flows from the investment are therefore as shown in the following timeline:

Year	0	1	2	3	4
Purchase Bond	-\$107.72				
Receive Coupons		\$6	\$6	\$6	\$6
Sell Bond					\$105.08
Cash Flows	-\$107.72	\$6.00	\$6.00	\$6.00	\$111.08

- b. We can compute the IRR of the investment using the annuity spreadsheet. The PV is the purchase price, the PMT is the coupon amount, and the FV is the sale price. The length of the investment is $N = 4$ years. We then calculate the IRR of investment = 5%. Because the YTM was the same at the time of purchase and sale, the IRR of the investment matches the YTM.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4		-107.72	6	105.08	
Solve for Rate:		5.00%				=RATE(4,6,-107.72,105.08)

Evaluate: In order to find the cash flows from the investment for the first four years, we need to find the initial investment in year 0 as well as the price that the bond sold for in year 4, along with the coupon payment each year of \$6. Note that the \$107.72 initial investment of the bond is trading above par because the coupon rate of 6.00% exceeds the yield to maturity of 5.00%. Also, we can see that because the yield to maturity remained the same at the time of purchase and when the bond sold, the IRR of the investment is identical to the yield to maturity.

-  **23. Plan:** We need to compute the price of each bond for each yield to maturity and then calculate the percentage change in the prices. We can use Eq. (6.3) to compute the prices.

Execute: We can compute the price of each bond at each YTM using Eq. 6.3. For example, with a 6% YTM, the price of Bond A per \$100 face value is:

$$P(\text{Bond A, 6\% YTM}) = \frac{100}{1.06^{15}} = \$41.73$$

The price of Bond D is:

$$P(\text{Bond D, 6\% YTM}) = 8 \times \frac{1}{0.06} \left(1 - \frac{1}{1.06^{10}} \right) + \frac{100}{1.06^{10}} = \$114.72$$

One can also use the Excel formula to compute the price: =PV(YTM, NPER, PMT, FV).

Once we compute the price of each bond for each YTM, we can compute the percent price change as

$$\text{Percent change} = \frac{(\text{Price at 5\% YTM}) - (\text{Price at 6\% YTM})}{(\text{Price at 6\% YTM})}$$

The results are shown in the table below:

Bond	Coupon Rate (annual payments)	Maturity (years)	Price at 6% YTM	Price at 5% YTM	Percentage Change
A	0%	15	\$ 41.73	\$ 48.10	15.3%
B	0%	10	\$ 55.84	\$ 61.39	9.9%
C	4%	15	\$ 80.58	\$ 89.62	11.2%
D	8%	10	\$114.72	\$123.17	7.4%

Evaluate: The 15-year zero-coupon bond is the most sensitive to the decrease in the bond's yield to maturity, while the 10-year bond shows the least sensitivity. In addition, both of the 15-year bonds are more sensitive than the 10-year bonds, proving that long-term bonds are riskier than short-term bonds.

24. Bond A is most sensitive because it has the longest maturity and no coupons. Bond D is the least sensitive. Intuitively, higher coupon rates and a shorter maturity typically lower a bond's interest rate sensitivity.



25. **Plan:** We must compute both the purchase price of the bond and the sale price of the bond for each separate scenario. In the first scenario (A), the yield to maturity is the same when the bond was purchased and when the bond was sold, and we can compute the price of the bond with 25 years left exactly as we did for 30 years but using 25 years of discounting instead of 30. With Scenarios B and C, we must use the old yield to maturity to find the purchase price and the new yield to maturity to find the sale price.

Once we have found the prices for each scenario, we can compute the IRR of each scenario just as we did in Chapter 4. The FV is the price in five years, the PV is the initial price, and the number of years is five.

Execute:

- Purchase price = $100/1.06^{30} = 17.41$. Sale price = $100/1.06^{25} = 23.30$. Return = $(23.30/17.41)^{1/5} - 1 = 6.00\%$; i.e., because YTM is the same at purchase and sale, IRR = YTM.
- Purchase price = $100/1.06^{30} = 17.41$. Sale price = $100/1.07^{25} = 18.42$. Return = $(18.42/17.41)^{1/5} - 1 = 1.13\%$; i.e., because YTM rises, IRR < initial YTM.
- Purchase price = $100/1.06^{30} = 17.41$. Sale price = $100/1.05^{25} = 29.53$. Return = $(29.53/17.41)^{1/5} - 1 = 11.15\%$; i.e., because YTM falls, IRR > initial YTM.
- Even without default, if you sell prior to maturity, you are exposed to the risk that the YTM may change.

Evaluate: In Scenario A, the bond's yield to maturity did not change, meaning that the IRR of the investment in the bond equals its yield to maturity even if the bond is sold early. If the yield to maturity increases, then the IRR will become less than the initial yield to maturity, while the opposite will occur if the yield to maturity decreases.

- 26. Plan:** We can use the bond's yield to maturity to compute the bond's price as the present value of its face amount, where the discount rate is the bond's yield to maturity. We can compute the credit spread by taking the yield to maturity of each security and subtracting the yield to maturity for the Treasury bill.

Execute:

- a. The price of this bond will be $P = 100 / (1 + .041) = \$96.061$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	1	4.100%		0	100	
Solve for PV:			(96.061)			=PV(0.041,1,0,100)

- b. The credit spread on AAA-rated corporate bonds is $0.041 - 0.038 = 0.3\%$.
 c. The credit spread on B-rated corporate bonds is $0.052 - 0.038 = 1.4\%$.
 d. The credit spread increases as the bond rating falls, because lower rated bonds are riskier.

Evaluate: We can compute the price of a zero-coupon bond simply by computing the present value of the face amount using the bond's yield to maturity. The credit spread on the AAA rated corporate bonds is less than the credit spread on the B-rated corporate bonds because lower rated bonds are riskier and the credit spread increases as the bond rating falls.

- 27. Plan:** Given the bond's yield to maturity, we can compute the price using Eq. 6.3. Note that the cash flows of this bond are an annuity of 10 payments of \$80, paid annually, and one lump-sum cash flow of \$1,000 (the face value), paid in 10 years.

Execute:

- a. When originally issued, the price of the bonds was

$$80[1 - 1/(1.058)^{10}] / 0.058 + 1,000 / (1.058)^{10} = \$1,163.47$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	5.8%		80	1000	
Solve for PV:			(1163.47)			=PV(0.058,10,80,1000)

- b. If the bond is downgraded, its price will fall to
 $80[1 - 1/(1.062)^{10}] / 0.062 + 1,000 / (1.062)^{10} = \$1,131.24$


	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10	6.2%		80	1000	
Solve for PV:			(1131.24)			=PV(0.062,10,80,1000)

Evaluate: The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield we can find the bond's price. The bond's price has lowered from \$1,163.47 to \$1,131.24, raising the yield to maturity from 5.80% to 6.20% APR. The present value of the bond payments equal to the current market price of the bond is lowered by increasing the discount rate of the bond.

- 28.** Your firm has a credit rating of A. You notice that the credit spread for five-year maturity A debt is 85 basis points (0.85%). Your firm's five-year debt has a coupon rate of 6%. You see that new five-year Treasury notes are being issued at par with a coupon rate of 2.0%. What should the price of your outstanding five-year bonds be?

We can price your debt as percentage of par (per \$100 par value): 6% of \$100 is \$6, paid as \$3 every six months. In that case, your debt makes \$3 payments every six months for five years and then pays \$100 par. The appropriate YTM is the comparable Treasury plus the credit spread: 0.0285, which is the APR. That corresponds to a six month rate of $0.0285/2 = 0.01425$

$$\text{Price} = PV = \frac{3}{0.01425} \left[1 - \frac{1}{(1.01425)^{10}} \right] + \frac{100}{(1.01425)^{10}} = 114.58$$

-  **29. Plan:** We can use the bond's yield to maturity to compute the bond's price as the present value of its face amount, where the discount rate is the bond's yield to maturity.

Using the price of the bond, we can find the total principal amount of these bonds by dividing the price of the bonds into the \$10 million HMK would like to raise.

In order to find the rating that would sell the bonds at par, the coupon rate of the bond must equal the yield of the bond.

To find the rating of the bond given the price, we can use Eq. 6.3 to solve for the yield to maturity and then match that yield to maturity to the bond ratings to find the specific rating, as well as whether or not the bonds are junk bonds.

Execute:

- a. The price will be:

$$P = \frac{65}{(1+0.063)} + \dots + \frac{65+1,000}{(1+0.063)^5} = \$1,008.36$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5	6.300%		65	1,000	
Solve for PV:			(1,008.36)			=PV(0.063,5,65,1000)

- b. Each bond will raise \$1,008.36, so the firm must issue:

$$\frac{\$10,000,000}{\$1,008.36} = 9,917.13 \Rightarrow 9,918 \text{ bonds.}$$

This will correspond to a principal amount of $9,918 \times \$1,000 = \$9,918,000$.

- c. For the bonds to sell at par, the coupon must equal the yield. Because the coupon is 6.5%, the yield must also be 6.5%, or A-rated.

d. First, compute the yield on these bonds:

$$959.54 = \frac{65}{(1 + \text{YTM})} + \dots + \frac{65 + 1,000}{(1 + \text{YTM})^5} \Rightarrow \text{YTM} = 7.5\%$$


	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5		-959.54	65	1,000	
Solve for Rate:		7.50%				=RATE(5,65,-959.54,1000)

Given a yield of 7.5%, it is likely these bonds are BB-rated. Yes, BB-rated bonds are junk bonds.

Evaluate: The yield to maturity is the discount rate that equates the present value of the bond's cash flows with its price. By discounting the cash flows using the yield, we can find the bond's price.

In order for a bond to sell at par, the coupon rate must equal the yield to maturity. For these bonds, the coupon rate is 6.5%, so the bonds must be A-rated with a yield of 6.5%.

Given the yield of 7.5%, these bonds are BB-rated, and they are in the bottom five categories. Bonds in the bottom five categories are often called junk bonds because their likelihood of default is high.

 **30. Plan:** We can use the bond's yield to maturity to compute the bond's price as the present value of its face amount, where the discount rate is the bond's yield to maturity.

We can compute the credit spread by taking the yield to maturity of each security and subtracting the yield to maturity for the Treasury bill.

Execute:

a. $25[1 - 1/(1.034)^{16}] / 0.034 + 1,000 / (1.034)^{16}$
 = \$890.33
 = 89.03%

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	16	3.4%		25	1000	
Solve for PV:			(890.33)			=PV(0.034,16,25,1000)

b. $25[1 - 1/(1.0425)^{16}] / 0.0425 + 1,000 / (1.0425)^{16}$
 = \$799.79
 = 79.79%

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	16	4.25%		25	1000	
Solve for PV:			(799.79)			=PV(0.0425,16,25,1000)

c. The credit spread on the BBB bonds = $8.5\% - 6.8\% = 1.7\%$

Evaluate: The Treasury bill is priced higher and has a lower yield to maturity than the BBB-rated corporate bond, which all else being equal, has a lower price and a higher yield to maturity, proving that all else being equal, a higher yield to maturity will produce a lower price of the bond.

The credit spread on the BBB-rated corporate bond is low because lower-rated bonds are riskier and the credit spread increases as the bond rating falls.

Chapter 7

Stock Valuation

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. $15,000 \times \$0.27 = \$4,050$.
2. With cumulative voting, you are able to get proportional representation by putting all of your votes toward two directors, allowing you to elect representatives to two seats (20% of 10 seats) on the board.

With noncumulative voting, you vote on each director individually and without a majority of the shares, you cannot ensure that your representative will win any of the elections (you could lose 80% to 20% in each of the 10 individual elections).

3. To make this easier, assume there are 100 shares of class A and 100 shares of class B. You then own 10 class A shares (10%) and 20 class B shares (20%). Because class B shares have 10 times the voting rights of class A, there are a total of $100 + 100(10) = 1,100$ votes. You have $10 + 20(10) = 210$ of those votes, or $210/1,100 = 0.191$ (19.1%).
4. **Plan:** The price of the stock in one year given the current price of \$65.00, the \$2.5 dividend, and the 12% cost of capital is:

Execute: $65 = (2.5 + X)/1.12$

$X = 70.3$

Evaluate: At a current price of \$65, we can expect Evco stock to sell for \$70.3 immediately after the firm pays the dividend in one year.

5. $\text{Div yld} = 1.50/37.50 = 4\%$

$\text{New Price} = 1.75/0.04 = \43.75 (note that $1.75 / 43.75 = 0.04$)

- 6. Plan:** We can rearrange Eq. 7.1 to find the cost of capital given the current stock price of \$20, the \$1 expected dividend, and the expected stock price right after paying the dividend of \$22. We can use Eq. 7.2 to calculate the dividend yield and the capital gain.

Execute:

$$\begin{aligned}
 r_E &= \frac{\text{Div}_1 + P_1}{P_0} - 1 \\
 &= \underbrace{\frac{\text{Div}_1}{P_0}}_{\text{Dividend Yield}} + \underbrace{\frac{P_1 - P_0}{P_0}}_{\text{Capital Gain Rate}} \\
 r_E &= \frac{1}{20} + \frac{22 - 20}{20} \\
 &= 0.15 = 15\%
 \end{aligned}$$

Dividend Yield: 5% (1/20)

Capital Gain: 10% (2/20)

Evaluate: The cost of capital for Anle Corporation is 15% given the current stock price of \$20 and the expected stock price of \$22 after paying the dividend of \$1 in one year. The cost of capital is then split between the dividend yield at 5% and the capital gains yield at 10%, which together creates the 15% cost of capital.

- 7. Plan:** We can use the constant dividend growth model (Eq. 7.6) with a growth rate of 0 because this preferred stock pays a constant (nongrowing) dividend. $\text{Div}_1 = 5$, $r = 0.12$, $g = 0$.

Execute:

$$P = \text{Div}_1 / (r - g) = 5 / (0.12 - 0) = 41.67$$

Evaluate:

To be consistent with the promised dividend and the required return, the price would be \$41.67.

- 8.** Dividend Yield = $\text{Div}/P = \$3.50/\$52 = 0.0673$ (6.73%).
- 9. Plan:** We can use Eq. 7.1 to solve for the beginning price we would pay now (P_0) given our expectations about dividends (\$5) and future price (\$78) and the return we need to expect to earn to be willing to invest 15%. We can use Eq. 7.1 to solve for the price for which you would expect to be able to sell a share of Acap stock in one year given our expectations about dividends (\$6.5) next year and future price (\$78) and the return we need to expect to earn to be willing to invest 15%. Given the price you would expect to be able to sell a share of Acap stock for in one year, we can solve for the price you would be willing to pay for a share of Acap stock today if you planned to hold the stock for only one year using the dividend of \$5 and the expected return of 15%.

Execute:

- a. $P(0) = 5 / 1.15 + (6.5 + 78) / 1.15^2 = \68.24
- b. $P(1) = (6.5 + 78) / 1.15 = \73.48
- c. $P(0) = (5 + 73.48) / 1.15 = \68.24

Evaluate: The price you would be willing to pay for a share of Acap stock today if you held the stock for one or two years is not affected by the amount of time you hold the stock as can be seen in parts (a) and (c).

- 10. Plan:** We can use Eq. 7.2 to calculate the dividend yield and the capital gain. We can then compute the total expected return by adding the dividend yield to the capital gain.

Execute:

Dividend Yield = $2 / 32.00 = 6.25\%$

Capital Gain Rate = $(35 - 32) / 32 = 9.38\%$

Total Expected Return = $r_E = 6.25\% + 9.38\% = 15.63\%$

Evaluate: The stock's dividend yield of 6.25% is the expected annual dividend of the stock dividend by its current price. The dividend yield is the percentage return the investor expects to earn from the dividend paid by the stock. The capital gain of 9.38% reflects the capital gain the investors will earn on the stock, which is the difference between the expected sale price and the original purchase price for the stock. The sum of the dividend yield and the capital gain rate is called the total return of the stock. The total return is the expected return that the investor will earn for a one-year investment in the stock.

- 11. Plan:** We can use Eq. (7.6) to calculate the price per share, and we can use Eq. (5.1) to calculate the quarterly rate from the annual cost of capital.

Execute: With simplifying assumption that dividends are paid at the end of the year, then the stock pays a total of \$2.8 in dividends per year. Valuing this dividend as a perpetuity, we have, $P = \$2.8 / 0.13 = \21.54 .

Alternatively, if the dividends are paid quarterly, we can value them as a perpetuity using a quarterly discount rate of $(1.13)^{1/4} - 1 = 3.103\%$ (see Eq. 5.1), then $P = \$0.70 / 0.03103 = \22.56 .

Evaluate: In this case, we can see that the price per share is greater the more frequently that the dividends are paid out. In this case, the price per share is \$22.56 when the dividends are paid out quarterly and \$21.54 when the dividends are paid out yearly.

- 12. Plan:** Because the dividends are expected to grow perpetually at a constant rate, we can use Eq. (7.6) to value Summit Systems. The next dividend is expected to be \$2.30, the growth rate is 5%, and the equity cost of capital is 18%.

Execute: $P = 2.30 / (18\% - 5\%) = \17.69

Evaluate: You would be willing to pay 7.69 times this year's dividend of \$2.30 to own Summit System's stock because you are buying a claim to this year's dividend and to an infinite growing series of future dividends. In other words, with constant expected dividend growth, the expected growth rate of the share price matches the growth rate of the dividends.

- 13. Plan:** Because we know that Dorpac currently has an equity cost of capital of 15% and a dividend yield of 5.5%, we can use Eq. 7.7 to estimate the growth rate.

Execute:

- $r_E = \text{Div Yld} + g$, so $15\% - 5.5\% = g = 9.5\%$.
- With constant dividend growth, share price is also expected to grow at rate $g = 9.5\%$.

Evaluate: In this case, Dorpac Corporation has a constant growth rate; therefore, the dividends are expected to grow at the same rate as the share price, i.e., 9.5%.

- 14. Plan:** Knowing the earnings per share for next year of \$4.00 and the retention rate of 40%, we can compute the dividend next year. We can compute the dividend growth rate using the return on new investment and the retention rate (see Eq. 7.12). Finally, we can compute the current stock price using Eq. 7.6.

Execute:

Earnings this year: \$4.00 per share

Dividends this year: $4.00 \times (1 - 0.40) = 2.40$ per share

Because Laurel plans to keep its payout rate constant, its dividend growth rate will be the same as its earnings growth rate (see Eq. 7.12). By Eq. 7.11, earnings growth rate is Retention rate \times Return on new investment $= 0.40 \times 0.10 = 0.04$.

Current stock price: $P = \frac{2.40(1 + 0.04)}{0.10 - 0.04} = 41.60$

Evaluate: The current stock price for Laurel Enterprises is \$41.60. This price is consistent with Laurel's expected future dividend stream.

- *15. Plan:** Several interrelated calculations will be needed to answer the following Questions a, b, and c.

Execute:

- Eq. (7.12): $g = \text{retention rate} \times \text{return on new invest} = (2/5) \times 15\% = 6\%$.
- $P = 3/(12\% - 6\%) = \$50$.
- $g = (1/5) \times 15\% = 3\%$, $P = 4/(12\% - 3\%) = \$44.44$. No, projects are positive NPV (return exceeds cost of capital), so do not raise the dividend.

Evaluate: DBF's growth rate is 6%. Its stock will sell for \$50.00. DBF should not raise the dividend because it will result in a lower stock price of \$44.44.

- 16. Plan:** We must estimate the stock price of Cooperton Mining after the dividend cut and new investment policy. If the stock price were to fall, we would not cut the dividend.

Execute:

Estimate r_E : $r_E = \text{Div Yield} + g = 4/50 + 3\% = 11\%$

New Price: $P = 2.50/(11\% - 5\%) = \41.67

Evaluate: In this case, cutting the dividend will reduce the stock price to \$41.67. The move to cut the dividend and to expand is not positive NPV. Do not do it.

- 17. Plan:** Gillette's dividend is expected to grow at 12% per year for five years and then at 2% per year indefinitely. We should employ a two-stage growth model. First, we value the constant growth in dividends five years from now and discount it to the present. Then we determine the value today of the five dividend payments growing at 12% from year 1 to 5. The value of the stock today is the sum of these two values.

Execute: Value of the first five dividend payments

$$\begin{aligned} PV_{1-5} &= \frac{0.65}{(0.08 - 0.12)} \left(1 - \left(\frac{1.12}{1.08} \right)^5 \right) \\ &= \$3.24 \end{aligned}$$

Value on date 5 of the rest of the dividend payments

$$\begin{aligned} PV_5 &= \frac{0.65(1.12)^4 1.02}{0.08 - 0.02} \\ &= 17.39 \end{aligned}$$

Discounting this value to the present gives

$$\begin{aligned} PV_0 &= \frac{17.39}{(1.08)^5} \\ &= \$11.83 \end{aligned}$$

So, the value of Gillette is

$$\begin{aligned} P &= PV_{1-5} + PV_0 \\ &= 3.24 + 11.83 \\ &= \$15.07 \end{aligned}$$

Evaluate: Gillette's stock today is worth \$15.07, which is the sum of \$3.24 (the present value of the first five dividends) and \$11.83 (the present value of the dividends growing at 2% per year from year 6 onward).

18. The expected dividends are

1	2	3	4	...
1	1.15	1.25	$1.30 = (1.25)(1.04)$	Continue growing by 4%

$$\text{Price} = PV = \frac{1.00}{1.12} + \frac{1.15}{(1.12)^2} + \frac{1.25}{(1.12)^3} + \left(\frac{1}{(1.12)^3} \right) \left(\frac{1.30}{0.12 - 0.04} \right) = 14.27$$

Note, as we learned in chapter 4, the growing perpetuity that starts in year 4 is only discounted back three years because the perpetuity formula itself already gives the value in year 3 of a perpetuity starting in year 4.

- 19. Plan:** Colgate's dividend is expected to grow at 11% per year for five years and then at 5.2% per year indefinitely. We should employ a two-stage growth model. First, we value the constant growth in dividends five years from now and discount it to the present. Then we determine the value today of the five dividend payments growing at 11% from years 1 to 5. The value of the stock today is the sum of these two values.

Execute: PV of the first five dividends

$$\begin{aligned} PV_{\text{first 5}} &= \frac{0.96(1.11)}{0.085 - 0.11} \left(1 - \left(\frac{1.11}{1.085} \right)^5 \right) \\ &= 5.14217 \end{aligned}$$

PV of the remaining dividends in year 5

$$\begin{aligned} PV_{\text{remaining in year 5}} &= \frac{0.96(1.11)^5(1.052)}{0.085 - 0.052} \\ &= 51.5689 \end{aligned}$$

Discounting back to the present

$$\begin{aligned} PV_{\text{remaining}} &= \frac{51.5689}{(1.085)^5} \\ &= 34.2957 \end{aligned}$$

Thus the price of Colgate is

$$\begin{aligned} P &= PV_{\text{first 5}} + PV_{\text{remaining}} \\ &= 39.4378 \end{aligned}$$

Evaluate: Colgate's stock today is worth \$39.43, which is the sum of \$5.14 (the present value of the first five dividends) and \$34.29 (the present value of the dividends growing at 5.2% per year from year 6 onward).

- *20. Plan:** Build a spreadsheet of Halliford's expected EPS and dividends per share and then determine the present value of the expected dividends.

Execute: See the spreadsheet for Halliford's dividend forecast:

	Year	0	1	2	3	4	5	6
Earnings								
1	EPS Growth Rate (vs. prior yr)			25%	25%	12.5%	12.5%	5%
2	EPS		\$3.00	\$3.75	\$4.69	\$5.27	\$5.93	\$6.23
Dividends								
3	Retention Ratio		100%	100%	50%	50%	20%	20%
4	Dividend Payout Ratio		0%	0%	50%	50%	80%	80%
5	Div (2×4)		—	—	\$2.34	\$2.64	\$4.75	\$4.98

From year 5 on, dividends grow at a constant rate of 5%. Therefore,

$$P(4) = 4.75 / (10\% - 5\%)$$

$$= \$95$$

Then:

$$P(0) = 2.34 / 1.10^3 + (2.64 + 95) / 1.10^4$$

$$= \$68.45$$

Evaluate: The stock of Halliford's should sell for \$68.45 today. This represents the present value of the dividends that are expected to grow at different rates over time.

- 21.** Its current stock price is the PV of its total payout of \$20 million per year in perpetuity:

$$PV = \frac{\$20 \text{ million}}{0.13} = \$153.8462 \text{ million, then divided by 10 million shares} = \$15.38 \text{ per share.}$$

If it increases its total payout to \$30 million with the additional \$10 million in payout through repurchase, the new stock price will be:

$$PV = \frac{\$30 \text{ million}}{0.13} = \$230.7692 \text{ million, then divided by 10 million shares} = \$23.08 \text{ per share. ,}$$

So, it increases by \$7.70 per share

- 22. Plan:** Using the total payout method, the equity value will be the PV of the total future payouts. If the sum of dividends and repurchases remains at \$10 million in perpetuity, then we can calculate the equity value using the perpetuity formula with Total Payout = \$10 million and $r = 0.13$.

Execute: The equity value is \$10 million/0.13 = \$76.92 million. Dividing it by the current number of shares outstanding gives us the price per share: \$76.92 million/5 million shares = \$15.38 per share.

Evaluate: It does not matter how the payout is divided between repurchases and dividends—the total payout method focuses on the total amount per year. In this case, that total amount implies a share price of \$15.38.

- 23.** The expected total payouts are:

1	2	3	4	5	...
10	0	20	25	25.75	grow by 3%

$$\text{Price} = \text{PV} = \frac{10}{1.11} + \frac{0}{(1.11)^2} + \frac{20}{(1.11)^3} + \frac{25}{(1.11)^4} + \left(\frac{1}{(1.11)^4} \right) \left(\frac{25.75}{0.11 - 0.03} \right) = \$252.13 \text{ million,}$$

spread over 2 million shares for a price per share of \$126.07.

Note, as in chapter 4, a growing perpetuity starting in year 5 is only discounted back four years because the perpetuity formula gives you the value in year 4 of a perpetuity starting in year 5.

- 24. Plan:** With constant payout rates, earnings growth equals payout growth. Using the total payout model, we can value AFW's equity using the growing perpetuity formula.

Execute:

Total payouts this year = \$700 million (0.60) = \$420 million. Total payouts this year = \$700 million (0.60) = \$420 million.

$$PV = \frac{\$420 \text{ million}}{0.12 - 0.08} = \$10,500 \text{ million } (\$10.5 \text{ billion})$$

AFW has 200 million shares outstanding, so the price per share is \$10,500/200 = \$52.50.

Evaluate: Holding the payout ratio constant, the earnings growth rate implies the same payout growth rate. Given the total expected payout over time, the current price per share should be \$52.50.

- 25. Plan:** First, determine next year's dividends for the entire firm. Then value the entire firm's equity, recognizing that the equity cost of capital is 12% and the growth rate in dividend is 8%. Second, divide the total value of the firm's equity by the number of outstanding shares to determine the value of a single share.

Execute:

Total Payout next year = 5 billion \times 1.08 = \$5.4 billion

Equity Value = $5.4 / (12\% - 8\%) = \$135$ billion

Share Price = $135 / 6 = \$22.50$

Evaluate: The firm is expected to pay \$5.4 billion in dividends next year, which would mean the firm's total equity is \$136 billion. With 6 billion shares outstanding, each share is worth \$22.50.

- *26. Plan:** Make several interrelated calculations to determine the answers to a, b, and c.

Execute:

a. Earnings growth = EPS growth = dividend growth = 8%. Thus, $P = 6 / (20\% - 8\%) = \$50$

b. Using the total payout model, $P = 2 / (20\% - 16\%) = \50 .

c. $g = r_E - \text{Div Yield} = 20\% - 2/50 = 16\%$

Evaluate: Maynard's stock price would be \$50 if it paid out a \$6.00 dividend that would grow at 8% per year. The stock would also sell for \$50 if Maynard paid out a \$2.00 dividend that would grow at 16% per year.

Chapter 8

Investment Decision Rules

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Calculate the NPV by computing the present value of the 70,000 using $r = 0.06$.

Execute:

$$\begin{aligned}\text{NPV} &= -\$70,000 + \$80,000/1.06 \\ &= -\$70,000 + \$75,471.70 \\ &= \$5,471.70\end{aligned}$$

Evaluate: This is a good investment opportunity as it produces a positive NPV.

2. **Plan:** Calculate the NPV by computing the present value of the two positive cash flows using $r = 0.12$.

Execute:

$$\text{NPV} = -\$125,000 + \frac{\$50,000}{1.12} + \frac{\$90,000}{1.12^2} = -\$8,609.69$$

Evaluate: This is a bad investment opportunity as it produces a negative NPV. Even though the total of the cash flows is more than the investment, they come later in time and are not enough to overcome the time value of money at your cost of capital.

3. **Plan:** Determine the net present value of the proposal

$$\text{NPV} = \text{PV}_{\text{Benefits}} - \text{PV}_{\text{Costs}}$$

Execute: PV Benefits = \$280,000 in one year \div (\$1.15 in one year/\$ today) = \$243,478.26 today

$$\text{PV Costs} = \$248,000 \text{ today}$$

$$\text{NPV} = \$243,478.26 - \$248,000 = -\$4,521.74 \text{ today}$$

Evaluate: No, you should not take the contract, as the NPV of the contract is negative. This would destroy value for the firm.

4. You are preparing to produce some goods for sale. You will sell them in one year and you will incur costs of \$80,000 immediately. If your cost of capital is 7%, what is the minimum dollar amount you need to expect to sell the goods for in order for this to be a non-negative NPV?

Solution:

Setting the NPV to 0 and solving for the cash flow in one year:

$$NPV = 0 = -80,000 + \frac{CF_1}{(1.07)}, CF_1 = 80,000(1.07) = 85,600$$

5. **Plan:** The NPV of a project is the present value of the benefits minus the present value of the costs. Compute the NPV of the project. If NPV is positive, accept the project. If NPV is negative, reject the project.

If the project is accepted, then determine how much money a lender would be willing to lend against the cash flows of the project.

Execute:

$$NPV = PV_{\text{Benefits}} - PV_{\text{Costs}}$$

$$PV_{\text{Benefits}} = \$80\text{m}/1.12 = \$71.43\text{m}$$

$$PV_{\text{This year's cost}} = \$40\text{m today}$$

$$PV_{\text{Next year's cost}} = \$25\text{m}/1.12 = \$22.32\text{m}$$

$$NPV = \$71.43 - \$40 - \$22.32\text{m} = \$9.11\text{m today}$$

Accept the project.

Evaluate: The firm can borrow \$71.43 million today and pay it back with 12% interest using the \$80 million it will receive from the government ($\$71.43 \times 1.20 = 80$). The firm can use \$40 million of the \$71.43 million to cover its costs today, and save \$22.32 million in the bank earning 12% interest to cover its cost of $22.32 \times 1.20 = \$25$ million next year.

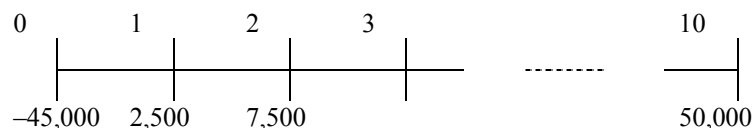
This leaves $71.43 - 40 - 22.32 = \$9.11$ million in cash for the firm today, the same amount as the NPV.



6. Plan:

- Draw a timeline to show when the cash flows will occur.
- Determine the NPV of the cash flows at 8% interest and 3% interest.

Execute:



- a. NPV of the cash flows at 8% interest:

$$\begin{aligned}\text{NPV} &= -\$45,000 + \frac{\$2,500}{1.08} + \frac{\$7,500}{1.08^2} + \frac{\$50,000}{1.08^{10}} \\ &= -\$45,000 + \$2,314.81 + \$6,430.04 + \$23,159.67 \\ &= -\$13,095.48\end{aligned}$$

- b. NPV of the cash flows at 3% interest:

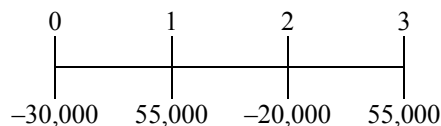
$$\begin{aligned}\text{NPV} &= -\$45,000 + \frac{\$2,500}{1.03} + \frac{\$7,500}{1.03^2} + \frac{\$50,000}{1.03^{10}} \\ &= -\$45,000 + \$2,427.18 + \$7,069.47 + \$37,204.70 \\ &= \$1,701.35\end{aligned}$$

Evaluate:

- a. Since at a 8% interest rate, the NPV is $-\$13,095.48$, which is less than zero, you would not take this investment opportunity.
- b. Since at a 3% interest rate, the NPV is $\$1,701.35$, which is greater than zero, you would take this investment opportunity.



7. **Plan** Draw the timeline of the cash flows for the investment opportunity. Compute the NPV of the investment opportunity at 8% interest per year to determine if it is an attractive investment opportunity.



Execute:

$$\begin{aligned}\text{NPV} &= -\$30,000 + \frac{\$55,000}{1.08} - \frac{\$20,000}{1.08^2} + \frac{\$55,000}{1.08^3} \\ &= -\$30,000 + 50,925.93 - 17,146.78 + 43,660.77 \\ &= \$47,439.92\end{aligned}$$

Evaluate: Since the investment opportunity has a positive NPV of $\$47,439.92$, Marian should make the investment.

8. **Plan:** We can compute the NPV of the project similarly to Eq. (8.3). The cash flows are an immediate $\$6.5$ million outflow followed by an annuity inflow of $\$3$ million per year for five years and a discount rate of 10%.

The cash flows are an immediate $\$6.5$ million outflow followed by an annuity inflow of $\$3$ million per year for 5 years at a discount rate of 10%.

Execute:

$$\text{NPV} = -\$6.5\text{m} + \frac{\$3\text{m}}{0.1} \left(1 - \frac{1}{1.1^5}\right)$$

You can also use a financial calculator to determine that the present value of the annuity of cash inflows is \$11,370,000.

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	5	10%		3	0	
Solve for PV:			(11.37)			=PV(0.1,5,3,0)
NPV = -\$6.5m + \$11.37m						
= \$4.87m						

The NPV rule dictates that you should accept this contract.

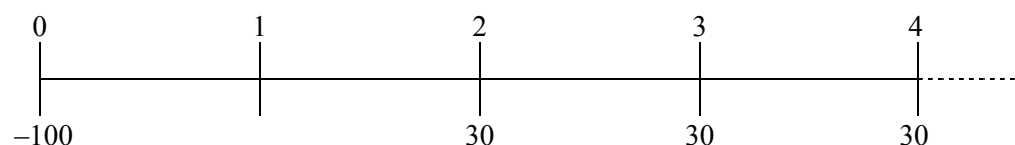
The NPV rule indicates that by making the investment, your factory will increase the value of the firm today by \$4.87 million, so you should undertake the project.

Evaluate: The NPV rule indicates that by making the investment, your factory will increase the value of the firm today by \$4.87 million, so you should undertake the project.

9. **Plan:** We can compute the NPV of the project using an approach similar to Eq. 8.3. The cash flows are an immediate \$100 million outflow followed by a perpetuity inflow of \$30 million per year, starting in year 2, and a discount rate of 8%. We can compute the IRR using a financial calculator or spreadsheet or by setting the NPV equal to zero and solving for r . After we find the IRR, we can compute the maximum deviation allowable in the cost of capital estimate to leave the decision unchanged by subtracting the cost of capital from the IRR.

Execute:

Timeline:



$$\begin{aligned}\text{NPV} &= \left(\frac{1}{1.08} \right) \frac{30}{0.08} - 100 \\ &= \$247.22 \text{ million}\end{aligned}$$

The IRR solves

$$\left(\frac{1}{1+r} \right) \frac{30}{r} - 100 = 0 \Rightarrow r = 24.16\%$$

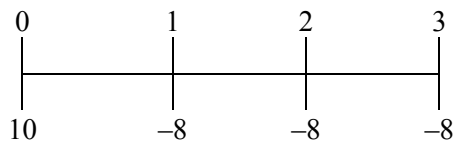
So, the cost of capital can be underestimated by 16.16% without changing the decision.

Evaluate: The NPV rule indicates that by making the investment, your factory will increase the value of the firm today by \$4.885 million, so you should undertake the project. The IRR is the discount rate that sets the net present value of the cash flows equal to zero. The difference between the cost of capital and the IRR tells us the amount of estimation error in the cost of capital estimate that can exist without altering the original decision.

- 10. Plan:** We can compute the NPV of agreeing to write the book, ignoring any royalty payments, using an approach similar to Eq. 8.3. The cash flows are an immediate \$10 million outflow followed by an annuity inflow of \$8 million per year for three years and a discount rate of 10%. We can compute the NPV of the book with the royalty payments by first computing the present value of the royalties at year 3. Once we compute the royalties at year 3 we can compute the present value of the royalties today and add that number to the NPV of agreeing to write the book ignoring any royalty payments.

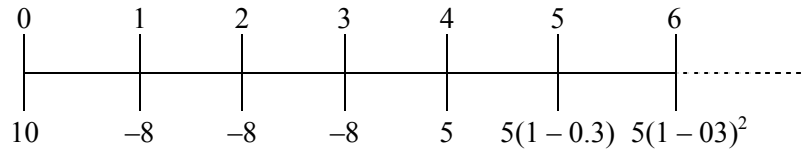
Execute:

a. Timeline:



$$\text{NPV} = 10 - \frac{8}{0.1} \left(1 - \frac{1}{(1.1)^3} \right) = -\$9.895 \text{ million}$$

b. Timeline:



First, calculate the PV of the royalties at year 3. The royalties are a declining perpetuity:

$$\begin{aligned} \text{PV}_3 &= \frac{5}{0.1 - (-0.3)} \\ &= \frac{5}{0.4} \\ &= 12.5 \text{ million} \end{aligned}$$

so the value today is

$$\begin{aligned} \text{PV}_{\text{royalties}} &= \frac{12.5}{(1.1)^3} \\ &= 9.391. \end{aligned}$$

Now add this to the NPV from part (a),

$$\begin{aligned} \text{NPV} &= -9.895 + 9.391 \\ &= -\$503,381. \end{aligned}$$

Evaluate: The NPV rule indicates that by agreeing to write the book (ignoring any royalties), you will decrease the value of the firm today by \$9.895 million, and by agreeing to write the book including royalties, you will decrease the value of the firm by only \$503,381 and therefore Bill should not undertake either project because both will decrease the value of the firm.



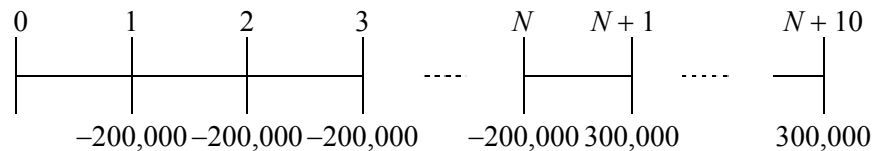
***11. Plan:** We can compute the NPV using an approach similar to Eq. 8.3, a spreadsheet on Excel, or a financial calculator. We can compute the IRR using a financial calculator or spreadsheet or by setting the NPV equal to zero and solving for r . After we find the IRR, we can compute the maximum deviation allowable in the cost of capital estimate to leave the decision unchanged by subtracting the cost of capital from the IRR. We can compute the length of time that the development must last to change the decision by using a financial calculator, a spreadsheet, or by setting the NPV equal to zero and solving for n .

Execute:

$$\begin{aligned} \text{a. NPV} &= -\frac{200,000}{r} \left(1 - \frac{1}{(1+r)^6} \right) + \left(\frac{1}{(1+r)^6} \right) \frac{300,000}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) \\ &= -\frac{200,000}{0.1} \left(1 - \frac{1}{(1.1)^6} \right) + \left(\frac{1}{(1.1)^6} \right) \frac{300,000}{0.1} \left(1 - \frac{1}{(1.1)^{10}} \right) \\ &= \$169,482 \end{aligned}$$

NPV > 0, so the company should take the project.

- b. Setting the NPV = 0 and solving for r (using a spreadsheet), the answer is IRR = 12.66%.
So if the estimate is too low by 2.66%, the decision will change from accept to reject.
- c. The new timeline is:



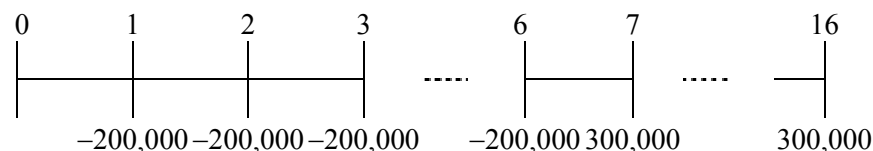
$$\text{NPV} = -\frac{200,000}{r} \left(1 - \frac{1}{(1+r)^N} \right) + \left(\frac{1}{(1+r)^N} \right) \left(\frac{300,000}{r} \right) \left(1 - \frac{1}{(1+r)^{10}} \right)$$

Setting the NPV = 0 and solving for N gives:

$$\begin{aligned} N &= \frac{\log \left(\frac{500,000 - \left(\frac{300,000}{(1+r)^{10}} \right)}{200,000} \right)}{\log(1+r)} \\ &= \frac{\log \left(2.5 - \frac{1.5}{1.1^{10}} \right)}{\log(1.1)} = 6.85 \text{ years} \end{aligned}$$

Assuming the cost of capital is 14%:

- a. Timeline:



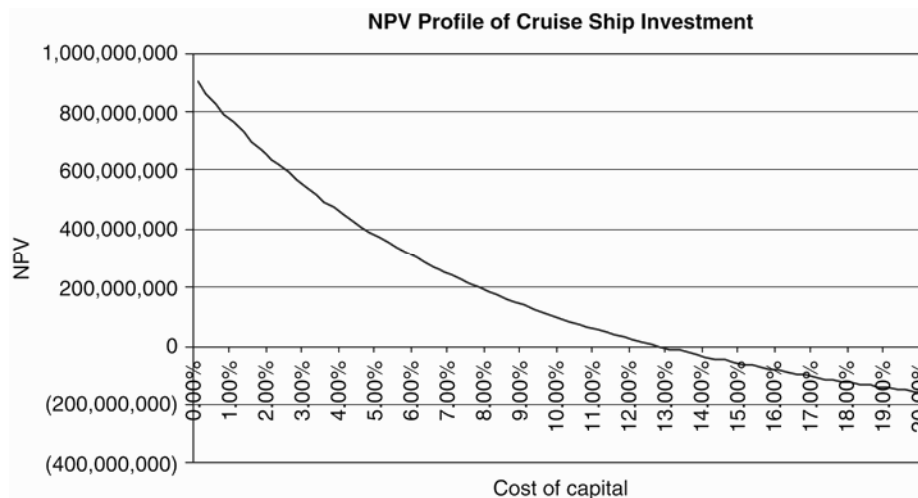
$$\begin{aligned}
 \text{NPV} &= -\frac{200,000}{r} \left(1 - \frac{1}{(1+r)^6} \right) + \left(\frac{1}{(1+r)^6} \right) \frac{300,000}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) \\
 &= -\frac{200,000}{0.14} \left(1 - \frac{1}{(1.14)^6} \right) + \left(\frac{1}{(1.14)^6} \right) \frac{300,000}{0.14} \left(1 - \frac{1}{(1.14)^{10}} \right) \\
 &= -\$64,816
 \end{aligned}$$

- b. Because the IRR still has not changed it is still 12.66%, so if the estimate is too *high* by 1.34%, the decision will change.
- c. Setting the NPV = 0 and solving for N gives:

$$\begin{aligned}
 \text{NPV} &= -\frac{200,000}{0.14} \left(1 - \frac{1}{(1.14)^6} \right) + \left(\frac{1}{(1.14)^6} \right) \frac{300,000}{0.14} \left(1 - \frac{1}{(1.14)^N} \right) = 0 \\
 &= -777,733.5 + 976,256.9 \left(1 - \frac{1}{(1.14)^N} \right) = 0 \\
 &= 198,523.4 = \frac{976,256.9}{(1.14)^N} = 0 \Rightarrow (1.14)^N = 4.9176 \\
 &\Rightarrow N \log(1.14) = \log(4.9176) \Rightarrow 0.131N = 1.5928 \Rightarrow N = 5.66 \text{ years}
 \end{aligned}$$

Evaluate: When your cost of capital is greater than your IRR, your project will produce a negative NPV, and according to the NPV rule, you should not accept this project if there is an alternative project with a higher or positive NPV. In this case, a lower cost of capital produced a higher NPV and also happens to be less of a time commitment because this project takes half the time of the second project.

12. a.



- b. The IRR is the point at which the line crosses the x -axis. In this case, it falls very close to 13%. Using Excel, the IRR is 12.72%.
- c. Yes, because the NPV is positive at the discount rate of 12%.
- d. The discount rate could be off by 0.72% before the investment decision would change.

13. $8,400/1,200 = 7$ months. You will recover your expenditure for the sign in 7 months.



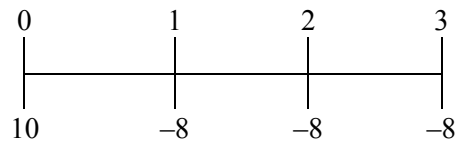
14. The IRR is 36.37%, which is larger than the required rate of return of 10%, so you should accept the project. The IRR rule agrees with the NPV rule.



15. **Plan:** We can compute the IRR by first computing the NPV and find the rate that sets that NPV equal to zero. In order to determine how many IRRs will set NPV equal to zero we can plot NPV as a function of the discount rate.

Execute:

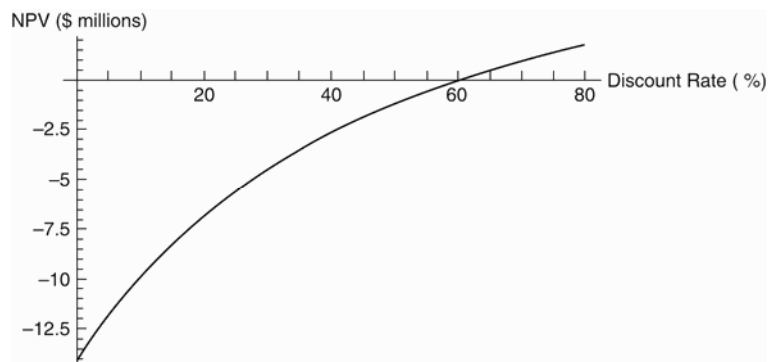
Timeline:



IRR is the r that solves

$$\begin{aligned} \text{NPV} &= 0 \\ &= 10 - \frac{8}{r} \left(1 - \frac{1}{(1+r)^3} \right) \end{aligned}$$

To determine how many solutions this equation has, plot the NPV as a function of r .



From the plot there is one IRR of 60.74%.

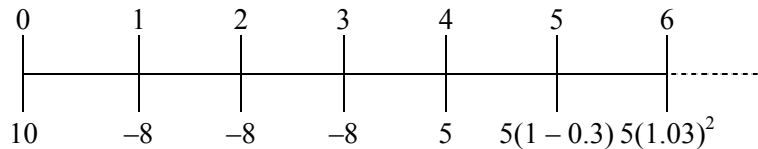
Because the IRR is much greater than the discount rate, the IRR rule says write the book. Because this is a negative NPV project (from 9.2(a)), the IRR gives the wrong answer.

Evaluate: In this case, there is only one IRR (the intercept on the x -axis), and the IRR is greater than the discount rate. According to the IRR rule, Bill should accept the project, yet because the NPV is negative, the NPV rule states that Bill should not accept the project. Although the two rules are conflicting, the NPV rule tends to be more reliable.

- 16. Plan:** We can compute the IRR by first computing the NPV and finding the rate that sets that NPV equal to zero. In order to determine how many IRRs will set NPV equal to zero, we can plot NPV as a function of the discount rate.

Execute:

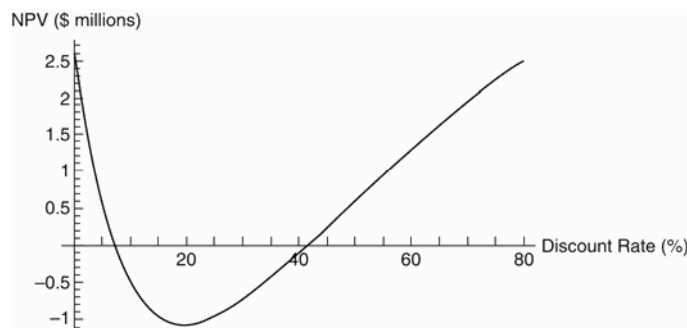
Timeline:



From 9.2(b) the NPV of these cash flows is:

$$\text{NPV} = 10 - \frac{8}{r} \left(1 - \frac{1}{(1+r)^3} \right) + \frac{1}{(1+r)^3} \left(\frac{5}{r+0.3} \right)$$

Plotting the NPV as a function of the discount rate gives:

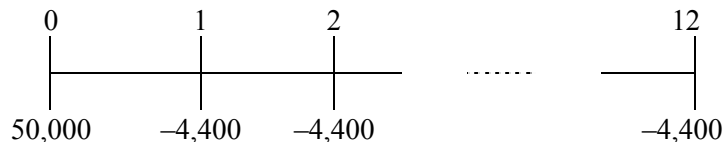


The plot shows that there are two IRRs—7.165% and 41.568%. The IRR does give an answer in this case, so it does *not* work.

Evaluate: In this case, there are two IRRs (the intercepts on the x -axis), and the IRR does not provide an answer, so we cannot use the IRR rule, and therefore the IRR rule does not work.

- 17. Plan:** Setting the NPV to zero, we can solve for the IRR, and we can then compute the NPV of the project using an approach similar to Eq. 8.3. The cash flows are an immediate \$50,000 cash flow followed by an annuity of \$4,400 per year and a discount rate of 15%.

Execute: The timeline of this investment opportunity is:



Computing the NPV of the cash flow stream:

$$\text{NPV} = 50,000 - \frac{4,400}{r} \left(1 - \frac{1}{(1+r)^{12}} \right)$$

To compute the IRR, we set the NPV equal to zero and solve for r . Using the annuity spreadsheet gives

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	12		50,000.00	-4,400	0	
Solve for Rate:		0.8484%				=RATE(12,-4400,50000,0)

The monthly IRR is 0.8484 because $(1.008484)^{12} = 1.106696$. 0.8484% monthly corresponds to an EAR of 10.67%. Smith's cost of capital is 15%, so according to the IRR rule, she should turn down this opportunity.

Let's see what the NPV rule says. If you invest at an EAR of 15%, then after one month you will have

$$(1.15)^{1/12} = 1.011715$$

so the monthly discount rate is 1.1715%. Computing the NPV using this discount rate gives

$$\begin{aligned} \text{NPV} &= 50,000 - \frac{4,400}{0.011715} \left(1 - \frac{1}{(1.011715)^{12}} \right) \\ &= \$1,010.06, \end{aligned}$$

which is positive, so the correct decision is to accept the deal. Smith can also be relatively confident in this decision. Based on the difference between the IRR and the cost of capital, her cost of capital would have to be $15 - 10.67 = 4.33\%$ *lower* to reverse the decision.

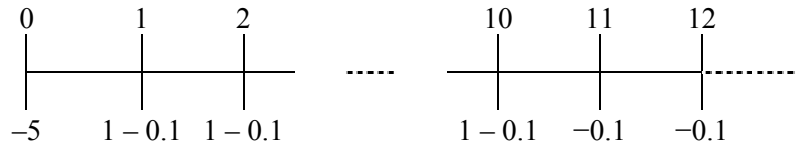
Evaluate: The internal rate of return (IRR) investment rule is based on the concept that if the return on the investment opportunity you are considering is greater than the return on other alternatives in the market with the equivalent risk and maturity, you should undertake the investment opportunity. In this case, the IRR is less than the discount rate, so according to the IRR rule, she should turn down this opportunity. The NPV rule states that when making an investment decision, take the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today. In this case, the NPV is positive, so the correct decision is to accept the deal.



- 18. Plan:** We can compute the NPV of the project using an approach similar to Eq. 8.3. Setting the NPV to zero, we can then solve for the IRR and then analyze the results according to the IRR rule.

Execute:

- a. Timeline:



The PV of the profits is:

$$PV_{\text{profits}} = \frac{1}{r} \left(1 - \frac{1}{(1+r)^{10}} \right)$$

The PV of the support costs is:

$$PV_{\text{support}} = \frac{0.1}{r}$$

$$NPV = -5 + PV_{\text{profits}} - PV_{\text{support}}$$

$$= -5 + \frac{1}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) - \frac{0.1}{r}$$

If $r = 6\%$, then $NPV = \$693,420$

If $r = 2\%$, then $NPV = -\$1,017,415$

If $r = 11\%$, then $NPV = -\$19,859$

- b. From the answer to part (a) there are at least two IRRs. We can see that because the NPV is negative at 2%, then is positive at 6%, and then is negative again at 11%. Therefore, the NPV profile must cross the x-axis at least twice.
- c. The IRR rule says nothing in this case because there are at least two IRRs.

Evaluate: The IRR investment rule is based on the concept that if the return on the investment opportunity you are considering is greater than the return on other alternatives in the market with the equivalent risk and maturity, you should undertake the investment opportunity. In this case, there are two IRRs, and therefore the IRR rule is not useful. The NPV rule states that when making an investment decision, take the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today. In this case, the NPV is positive only when the cost of capital is at 6%, and therefore they should accept the project at the cost of capital of 6% only.



- 19. Plan:** We can compute the IRR by first computing the NPV and finding the rate that sets that NPV equal to zero. In order to determine how many IRRs will set NPV equal to zero we can plot NPV as a function of the discount rate.

Execute: The timeline of this investment opportunity is:



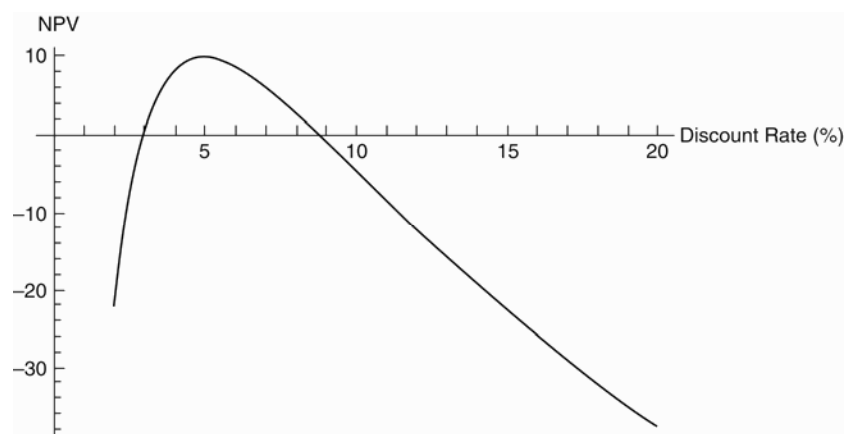
Computing the NPV of the cash flow stream:

$$\text{NPV} = -120 + \frac{20}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) - \frac{2}{r(1+r)^{10}}$$

You can verify that $r = 0.02924$ or 0.08723 gives an NPV of zero. There are two IRRs, so you cannot apply the IRR rule. Let's see what the NPV rule says. Using the cost of capital of 8% gives

$$\begin{aligned} \text{NPV} &= -120 + \frac{20}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) - \frac{2}{r(1+r)^{10}} \\ &= 2.621791 \end{aligned}$$

So the investment has a positive NPV of \$2,621,791. In this case, the NPV as a function of the discount rate is *n*-shaped.



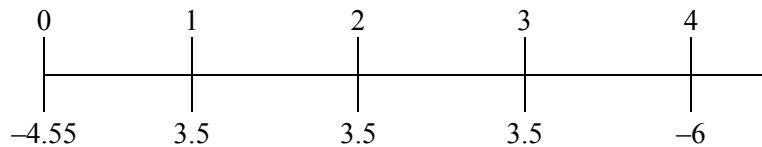
If the opportunity cost of capital is *between* 2.93% and 8.72%, the investment should be undertaken.

Evaluate: The IRR investment rule is based on the concept that if the return on the investment opportunity you are considering is greater than the return on other alternatives in the market with the equivalent risk and maturity you should undertake the investment opportunity. In this case, there are two IRRs and therefore the IRR rule is not useful. The NPV rule states that when making an investment decision, take the alternative with the highest NPV. Choosing this

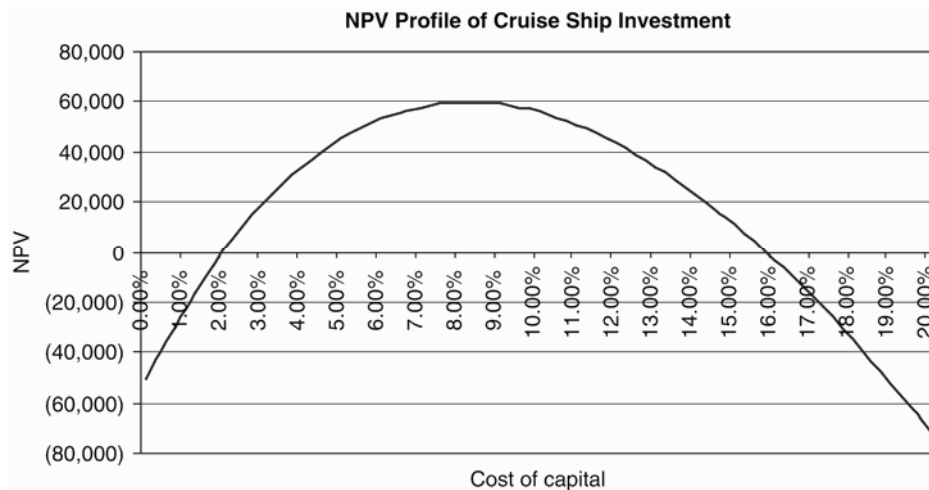
alternative is equivalent to receiving its NPV in cash today. In this case, the NPV is positive and the investment should be undertaken if the opportunity cost of capital is between 2.93% and 8.72%.

20. Plan: Compute various IRR calculations for the proposed project.

Execute: The timeline of the investment opportunity is:



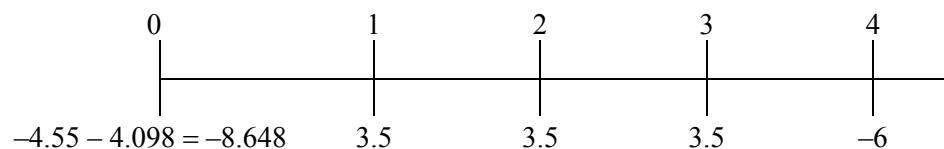
a. Looking at the NPV profile below, this project has two IRRs.



b. To use the MIRR approach, calculate the PV of the cleanup costs and add this value to the initial startup costs.

$$\begin{aligned} PV_{(\text{cleanup costs})} &= \frac{-6}{(1.10)^4} \\ &= -\$4.098 \end{aligned}$$

The new timeline of cash flows associated with this investment is now:



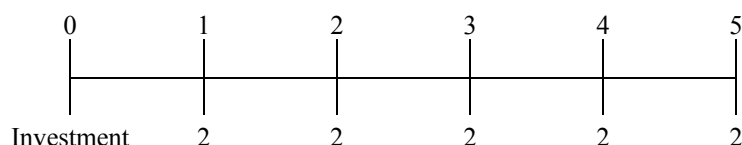
MIRR of these cash flows is 10.37%.

Evaluate:

c. MIRR is greater than the cost of capital, so the investment should be taken.

21. Plan: Compute the NPV of the project.

Execute: The timeline of the investment opportunity is:




To have an NPV greater than zero, the initial investment must be less than the PV of the 5-year annuity of \$2 million per year.

$$NPV = 0 < \text{Initial Investment} + \frac{2}{0.15} \left(1 - \frac{1}{1.15^5} \right)$$

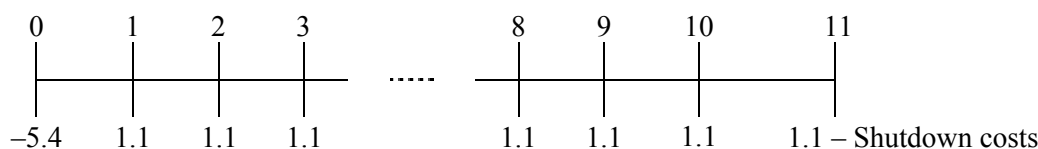
Initial investment > -\$6.7 million

Evaluate: The most you could pay for the project and achieve the 15% annual return is \$6.7 million.

 ***22. Plan:** Compute the modified IRR of the project.

Execute:

The timeline of the investment opportunity is:




In order to earn the 15% cost of capital, the NPV must be positive. To determine the maximum shutdown costs allowable to still have a positive NPV:

$$0 < NPV = -\$5.40 \text{ million} + \frac{\$1.1 \text{ million}}{0.15} \left(1 - \frac{1}{(1 + 0.15)^{10}} \right) + \frac{\text{Shutdown Costs}}{(1.15)^{11}}$$

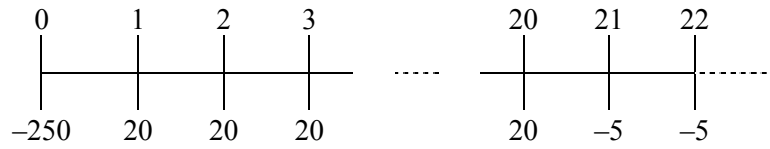
Shutdown costs < \$561,290

Evaluate: Shutdown costs cannot exceed \$561,290.

 ***23. Plan:** We can compute IRR of this investment by first computing the NPV by subtracting the stabilization costs of the project from the operating profit. We can then find the IRR of the investment by plotting the NPV as a function of the discount rate.

Execute:

Timeline:



$$PV_{\text{operating profits}} = \frac{20}{r} \left(1 - \frac{1}{(1+r)^{20}} \right)$$

In year 20, the PV of the stabilization costs is:

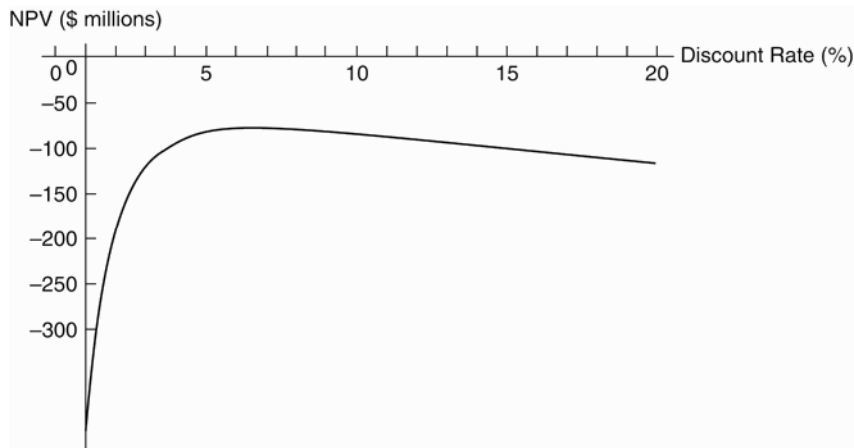
$$PV_{20} = \frac{5}{r}$$

So the PV today is:

$$PV_{\text{stabilization costs}} = \frac{1}{(1+r)^{20}} \left(\frac{5}{r} \right)$$

$$NPV = -250 + \frac{20}{r} \left(1 - \frac{1}{(1+r)^{20}} \right) - \frac{1}{(1+r)^{20}} \left(\frac{5}{r} \right)$$

Plotting this out gives



So no IRR exists.

Evaluate: In order for a project to be profitable, IRR has to be greater than the discount rate. In this case, since there is no IRR, NPV must be less than zero = 0.

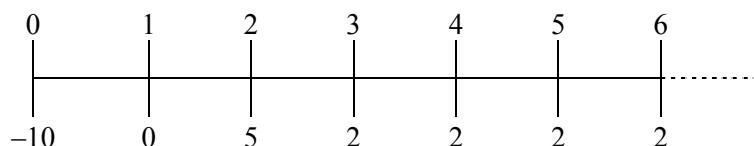
24. a. The payback period is four years ($4 \times 125,000 = 500,000$).

$$NPV = -500000 + \frac{125000}{.11} \left[1 - \frac{1}{(1.11)^{10}} \right] = -500000 + 736154 = 236154$$

- b. As the NPV is positive, you should proceed with the project because it will increase the value of the company even though it takes longer than the preferred payback period.
25. **Plan:** In order to implement the payback rule, we need to know whether the sum of the inflows from the project will exceed the initial investment before the end. We can compute the NPV of the project using an approach similar to Eq. 8.3.

Execute:

Timeline:



It will take five years to pay back the initial investment, so the payback period is five years. You will *not* make the movie.

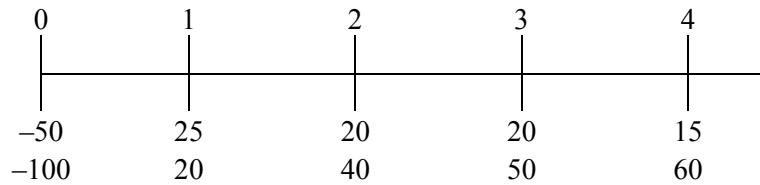
$$\begin{aligned} NPV &= -10 + \frac{5}{(1+r)^2} + \frac{2}{r} \left(1 - \frac{1}{(1+r)^4} \right) \frac{1}{(1+r)^2} \\ &= -10 + \frac{5}{(1.1)^2} + \frac{2}{0.1(1.1)^2} \left(1 - \frac{1}{(1.1)^4} \right) \\ &= -\$628,322 \end{aligned}$$

So the NPV agrees with the payback rule in this case.

Evaluate: Although simple to compute, the payback rule requires us to use an arbitrary cutoff period in summing the cash flows. Further, the payback rule does not discount future cash flows. Instead it simply sums the cash flows and compares them to a cash outflow in the present. In this case, you will not make the movie because your cutoff point is two years and it will take five years to pay back the initial investment. The NPV of this project came back as negative, so this also agrees with the payback rule, and the movie should therefore not be made.



- 26. Plan:** We can compute the IRR by using an approach similar to Eq. 8.3 and then rearranging it so that NPV equals zero and solving for r . Once we compute r , we can compute the NPV of both projects.



$$\text{a. } \text{NPV}_A = -50 + \frac{25}{1+r} + \frac{20}{(1+r)^2} + \frac{20}{(1+r)^3} + \frac{15}{(1+r)^4}$$

$$\text{IRR}(A) = 24\%$$

$$\text{NPV}_B = -100 + \frac{20}{1+r} + \frac{40}{(1+r)^2} + \frac{50}{(1+r)^3} + \frac{60}{(1+r)^4}$$

$$\text{IRR}(B) = 21\%$$

$$\begin{aligned} \text{b. } \text{NPV}_A &= -50 + \frac{25}{1+0.05} + \frac{20}{(1+0.05)^2} + \frac{20}{(1+0.05)^3} + \frac{15}{(1+0.05)^4} \\ &= 21.57 \end{aligned}$$

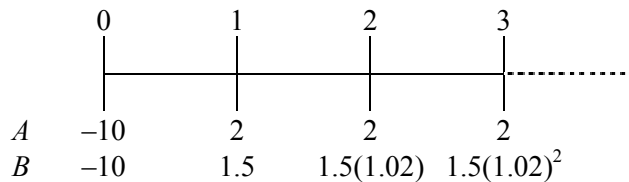
$$\begin{aligned} \text{NPV}_B &= -100 + \frac{20}{1+0.05} + \frac{40}{(1+0.05)^2} + \frac{50}{(1+0.05)^3} + \frac{60}{(1+0.05)^4} \\ &= 47.88 \end{aligned}$$

Evaluate: The IRR and NPV rank differently due to the difference in the initial investment. Investment A earns a higher rate of return on a smaller investment.

- 27. Plan:** Compute the timeline and the NPV and IRR for each project. Decide which one to accept.

Execute:

- a. Timeline:



$$\text{NPV}_A = \frac{2}{r} - 10$$

Setting $\text{NPV}_A = 0$ and solving for r

$$\text{IRR}_A = 20\%$$

$$\text{NPV}_B = \frac{1.5}{r - 0.02} - 10$$

Setting $NPV_B = 0$ and solving for r

$$\frac{1.5}{r - 0.02} = 10 \Rightarrow r - 0.02 = 0.15 \Rightarrow r = 17\%$$

So,

$$IRR_B = 17\%$$

Based on the IRR, you always pick Project *A*.

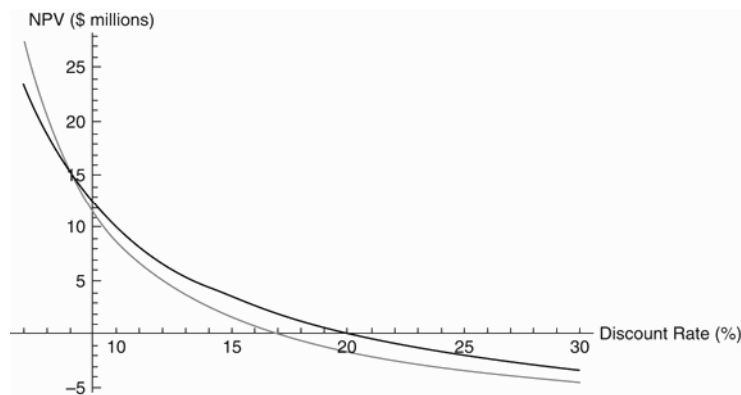
- b. Substituting $r = 0.07$ into the NPV formulas derived in part (a) gives

$$NPV_A = \$18.5714 \text{ million}$$

$$NPV_B = \$20 \text{ million}$$

So the NPV says take *B*

- c. Here is a plot of NPV of both projects as a function of the discount rate. The NPV rule selects *A* (and so agrees with the IRR rule) for all discount rates to the right of the point where the curves cross.



$$NPV_A = NPV_B$$

$$\frac{2}{r} = \frac{1.5}{r - 0.02}$$

$$\frac{r}{2} = \frac{r - 0.02}{1.5}$$

$$1.5r = 2r - 0.04$$

$$0.5r = 0.04$$

$$r = 0.08$$

Evaluate: Based on the IRR you always pick Project *A*.

Based on the NPV take *B*.

So the IRR rule will give the correct answer for discount rates greater than 8%.



28. Plan: Compute the NPV and the IRR of each project.

Execute: The timeline of the investment opportunity is:

0	1	2	3	4
-100	25	30	40	50
-100	50	40	30	20

a.
$$NPV_A = -100 + \frac{25}{1+0.11} + \frac{30}{(1+0.11)^2} + \frac{40}{(1+0.11)^3} + \frac{50}{(1+0.11)^4} = 9.06$$

$$NPV_B = -100 + \frac{50}{1+0.11} + \frac{40}{(1+0.11)^2} + \frac{30}{(1+0.11)^3} + \frac{20}{(1+0.11)^4} = 12.62$$

b. Solving for the discount rate that results in zero NPV

$$IRR(A) = 14.7\%$$

$$IRR(B) = 17.8\%$$

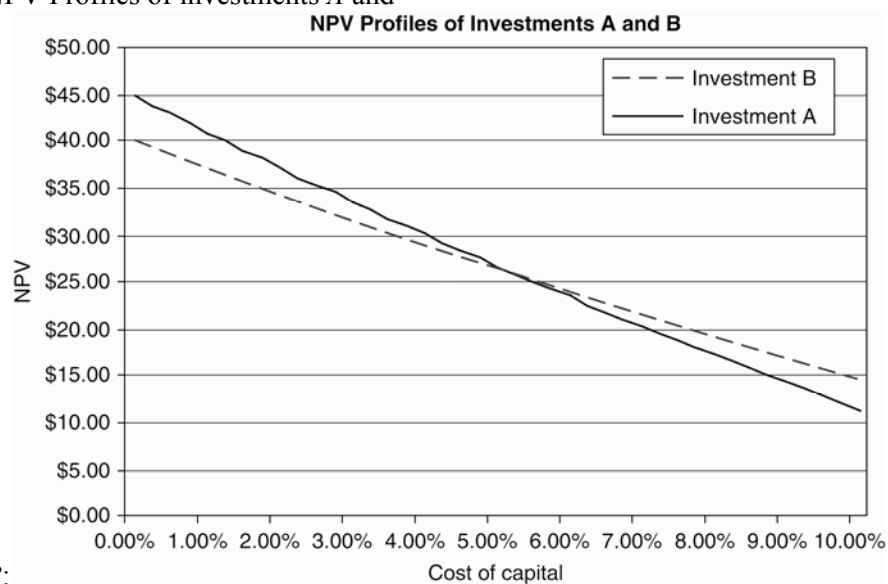
c. This can be solved two ways. One is to calculate the IRR of the difference in cash flows between the two projects. The other is to create NPV profiles of both investments and determine the cost of capital at which the NPVs of both projects are the same.

0	1	2	3	4
-100	25	30	40	50
-100	50	40	30	20
0	-25	-10	10	30

$$NPV = 0 = \frac{-25}{1+r} + \frac{-10}{(1+r)^2} + \frac{10}{(1+r)^3} + \frac{30}{(1+r)^4}$$

$$IRR = 5.567\%$$

NPV Profiles of investments A and B



B:

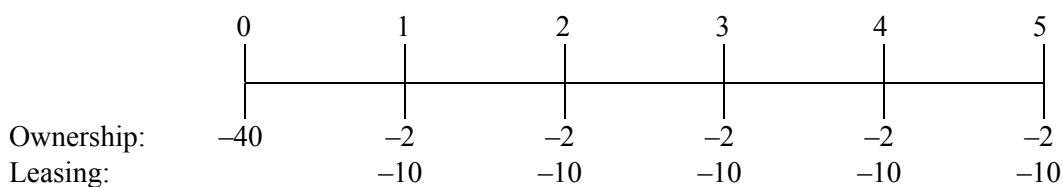
The profiles cross at a cost of capital of 5.567%.

Evaluate:

d. You should invest in B, as it has a higher NPV.

29. **Plan:** Compute the cost of ownership of the asset as well as the cost of leasing the asset. Select the option with the lowest cost.

Execute: The timeline of the investment opportunity is:



$$\begin{aligned}
 \text{NPV}_{\text{ownership}} &= -40 + \frac{-2}{0.07} \left(1 - \frac{1}{(1 + 0.07)^5} \right) \\
 &= -48.2 \\
 \text{NPV}_{\text{leasing}} &= \frac{-10}{0.07} \left(1 - \frac{1}{(1 + 0.07)^5} \right) \\
 &= -41
 \end{aligned}$$

Evaluate: The cost of leasing is less, so the firm should lease the equipment.

30. This is an equivalent annual cost problem applied to a monthly setting:

$$PV \text{ of costs of A} = 200 + \frac{60}{.0025} \left[1 - \frac{1}{(1.0025)^{24}} \right] = 1595.96$$

$$EAC : 1595.96 = \frac{EAC}{.0025} \left[1 - \frac{1}{(1.0025)^{24}} \right], \text{ so } EAC = \frac{1595.96}{\left[\frac{1}{.0025} - \frac{1}{(0.0025)(1.0025)^{24}} \right]} = \$68.60$$

$$PV \text{ of costs of B} = 100 + \frac{70}{.0025} \left[1 - \frac{1}{(1.0025)^{12}} \right] = 926.51$$

$$EAC : 926.51 = \frac{EAC}{.0025} \left[1 - \frac{1}{(1.0025)^{12}} \right], \text{ so } EAC = \frac{926.51}{\left[\frac{1}{.0025} - \frac{1}{(0.0025)(1.0025)^{12}} \right]} = \$78.47$$

Choose carrier A because it is cheaper once all the costs are considered.

31. Plan: Compute the NPV and the EAA of each bus. Choose the bus with the lowest costs.

Execute: The timeline of the investment opportunity is:

	0	1	2	3	4	5	6	7
Old Reliable:	-200	-4	-4	-4	-4	-4	-4	-4
Short and Sweet:	-100	-2	-2	-2	-2			

$$\begin{aligned} NPV_{\text{Old Reliable}} &= -200 + \frac{-4}{0.11} \left(1 - \frac{1}{(1 + 0.11)^7} \right) \\ &= -218.85 \end{aligned}$$

$$-218.85 = \frac{EAA_{\text{Old Reliable}}}{0.11} \left(1 - \frac{1}{(1 + 0.11)^7} \right)$$

$$EAA_{\text{Old Reliable}} = -46.44$$

$$\begin{aligned} NPV_{\text{Short and Sweet}} &= -100 + \frac{-2}{0.11} \left(1 - \frac{1}{(1 + 0.11)^4} \right) \\ &= -106.20 \end{aligned}$$

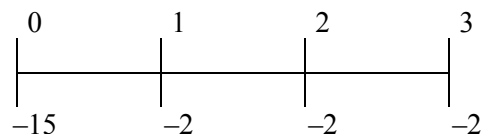
$$-106.20 = \frac{EAA_{\text{Short and Sweet}}}{0.11} \left(1 - \frac{1}{(1 + 0.11)^4} \right)$$

$$EAA_{\text{Short and Sweet}} = -34.23$$

Evaluate: The annual cost of the Short and Sweet bus is less, so they should buy this bus.

- 32. Plan:** Compute the NPV and the EAA of this investment opportunity. Determine the lowest value enhancing bid.

Execute: The timeline of the investment opportunity is:



$$\begin{aligned} \text{NPV} &= -15 + \frac{-2}{0.10} \left(1 - \frac{1}{(1 + 0.10)^3} \right) \\ &= -19.97 \end{aligned}$$

$$-19.97 = \frac{\text{EAA}}{0.10} \left(1 - \frac{1}{(1 + 0.10)^3} \right)$$

$$\text{EAA} = -8.032$$

Evaluate: Hassle-free could bid as little as \$8,032 per year and increase its value.

- 33.** This is an equivalent annual cost problem. Compare the EAC of buying and maintaining the copier to leasing it.

$$\text{PV of costs} = 2,000 + \frac{400}{0.06} \left[1 - \frac{1}{(1.06)^5} \right] = 3,684.95$$

$$\text{EAC} : 3684.95 = \frac{\text{EAC}}{0.06} \left[1 - \frac{1}{(1.06)^5} \right], \text{ so } \text{EAC} = \frac{3684.95}{\left[\frac{1}{0.06} - \frac{1}{(0.06)(1.06)^5} \right]} = 874.79$$

So, because buying and maintaining it is equivalent to paying \$874.79 per year for five years, that is the most you would pay to lease it.

- 34. Plan:** Compute the NPVs of the alternatives. Select the alternative with the highest NPV.

Execute:

a.

	NPV	Use of Facility	NPV/Use of Facility
<i>A</i>	\$2 million	100%	2
<i>B</i>	\$1 million	60%	1.67
<i>C</i>	\$1.5 million	40%	3.75

- b. They should invest in *B* and *C*. Together, these result in an NPV of \$2.5 million, which is greater than the \$2 million NPV earned by *A* alone.

- 35. Plan:** Compute the NPV and Profitability Index of each proposed investment. Select the best combination of investments.

Execute:

Project	NPV	Profitability Index
Parkside Acres	106,143	0.16
Real Property Estates	120,523	0.15
Lost Lake Properties	40,392	0.06
Overlook	80,131	0.53

Evaluate: The PI implies that Overlook and Parkside Acres should be selected. The alternative investment opportunities that meet the resource constraint are: (i) Real Property Estates alone, or (ii) Lost Lake and Overlook. These alternatives generate lower NPVs, so in this case the PI rule gives the correct answer, although as the text explains, this need not always be the case when the complete budget is not used by taking the projects in order.

- 36. Plan:** Compute the NPV and Profitability Index of each proposed investment. Select the best combination of investments.

Execute:

Project	PI	NPV/Head Count
I	1.01	5.1
II	1.27	6.3
III	1.47	5.5
IV	1.25	8.3
V	2.01	5.0

Evaluate:

- The PI rule selects Projects V, III, and II. These are also the optimal projects to undertake (as the budget is used up fully taking the projects in order).
- The additional constraint that only 12 research scientists are available will alter the set of projects that can be selected and the optimum number of projects to select. Specifically, Project V is the most attractive project with the highest PI. But because Project V requires 12 research scientists, selecting it would mean no other projects could be selected. (Taking Project V would also only use \$30 million of the \$60 million available.) The PI rule selects IV, II, III, and I because these projects have the highest PI and use the entire \$60 million and 12 research scientists. However, this choice of projects does not maximize NPV. This solution shows that it may be optimal to skip some projects in the PI ranking if they will not fit within the budget and resource constraints.

Chapter 9

Fundamentals of Capital Budgeting

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

- 1. Plan:** We can compute the total capitalization of the machine by adding the total cost of transporting and installing the machine to the initial cost of purchasing the machine, and this will provide us with the total cost of the machine that we must depreciate over the five years of the machine's life. In order to compute the annual depreciation expense of the machine, we can then take the total capitalization of the machine and divide it by the depreciable life of the machine.

Execute:

Capitalization of machine: \$8,070,000

Annual depreciation expense: $8,070,000/8 = \$1,008,750$

Evaluate: Rather than expensing the \$8,070,000 it costs to buy, ship, and install the machine in the year it was bought, accounting principles require you to depreciate the \$1,008,750 over the depreciable life of the equipment. Assuming the equipment has a eight-year depreciable life and that we use the straight-line method, we would expense $\$8,070,000/8 = \$1,008,750$ per year for eight years. The idea is to match the cost of acquiring the machine to the timing of the revenues it generates.

- 2. Plan:** We need four items to calculate incremental earnings: (1) incremental revenues, (2) incremental costs, (3) depreciation, and (4) the marginal tax rate.

Execute:

Annual incremental earnings = $(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \text{tax rate})$

$$\begin{aligned}\text{Annual incremental earnings} &= \$5,000,000 - 2,300,000 - 1,008,750 \times (1 - 0.4) \\ &= \$1,691,250 \times 0.6 \\ &= \$1,014,750\end{aligned}$$

Evaluate: These incremental earnings are an intermediate step on the way to calculating the incremental cash flows that would form the basis of any analysis of the project. The cost of the equipment does not affect earnings in the year it is purchased but does so through the depreciation expense in the following eight years. Note that the depreciable life, which is based on accounting rules, does not have to be the same as the economic life of the asset—the period over which it will have value.

- 3. Plan:** We can compute the incremental revenues by taking the percentage increase in sales of the 250,000 units multiplied by the \$25 sales price per unit.

Execute: Incremental revenues = $(0.18 \times 250,000) \times \$25 = \$1,125,000$

Evaluate A new product typically has lower sales initially, as customers gradually become aware of the product. Sales will then accelerate, plateau, and ultimately decline as the product nears obsolescence or faces increased competition. Similarly, the average selling price of a product and its cost of production will generally change over time. Prices and costs tend to rise with the general level of inflation in the economy.

- 4. Plan:** We can compute the level of incremental sales associated with introducing the new pizza assuming that customers will spend the same amount on either version by using the sales of the new pizza and the lost sales of the original pizza (30% of customers who switched to the new pizza multiplied by the \$50 million in new sales).

We can compute the level of incremental sales associated with introducing the new pizza assuming that 60% of the customers will switch to another brand by using the sales of the new pizza and the lost sales of the original pizza from the customers who would not have switched brands.

Execute:

- Sales of new pizza – lost sales of original = $50 - 0.30(50) = \$35$ million.
- Sales of new pizza – lost sales of original pizza from customers who would not have switched brands = $50 - 0.60(0.30)(50) = \$41$ million.

Evaluate: More incremental sales are generated if 30% of the customers who will switch from Pisa Pizza's original pizza to its healthier pizza will switch to another brand if Pisa Pizza does not introduce a healthier pizza than just the incremental sales associated with introducing the new pizza. A new product typically has lower sales initially, as customers gradually become aware of the product. Sales will then accelerate, plateau, and ultimately decline as the product nears obsolescence or faces increased competition. Similarly, the average selling price of a product and its cost of production will generally change over time. Prices and costs tend to rise with the general level of inflation in the economy.



- 5. Plan:** We need four items to calculate incremental earnings: (1) incremental revenues, (2) incremental costs, (3) depreciation, and (4) the marginal tax rate.

Execute:

	Year	1	2
Incremental Earnings Forecast (\$000s)			
1	Sales of Mini Mochi Munch	9,000	7,000
2	Other Sales	2,000	2,000
3	Cost of Goods Sold	(7,350)	(6,050)
4	Gross Profit	3,650	2,950
5	Selling, General & Admin.	(5,000)	—
6	Depreciation	—	—
7	EBIT	(1,350)	2,950
8	Income tax at 35%	473	(1,033)
9	Unlevered Net Income	(878)	1,918

Evaluate: These incremental earnings are an intermediate step on the way to calculating the incremental cash flows that would form the basis of any analysis of the project. Net income is negative in the first year because the additional selling, general, and administrative costs occurred only in the first year.

6. **Plan:** We can compute the incremental impact on this year's EBIT of the drop in price by subtracting the gross profit without the price drop from the gross profit with the price drop.

We can compute the incremental impact on EBIT for the next three years of a price drop in the first year from the additional sales on ink cartridges by finding the change in EBIT from ink cartridge sales, which will be the incremental impact on EBIT for years 2 and 3. Note that for year 1, we must remember to subtract the incremental impact on EBIT from the price drop in year one.

Execute:

$$\begin{aligned}\text{Change in EBIT} &= \text{Gross profit with price drop} - \text{Gross profit without price drop} \\ &= 32,500 \times (230 - 180) - 25,000 \times (280 - 180) \\ &= -\$875,000\end{aligned}$$

Change in EBIT from ink cartridge sales:

$$\begin{aligned}&= 32,500 \times \$85 \times 0.80 - 25,000 \times \$85 \times 0.80 \\ &= \$510,000\end{aligned}$$

Therefore, incremental change in EBIT for the next three years is:

$$\begin{aligned}\text{Year 1:} & \$510,000 - 875,000 = -\$365,000 \\ \text{Year 2:} & \$510,000 \\ \text{Year 3:} & \$510,000\end{aligned}$$

Evaluate: A new product typically has lower sales initially, as customers gradually become aware of the product. Sales will then accelerate, plateau, and ultimately decline as the product nears obsolescence or faces increased competition. Similarly, the average selling price of a product and its cost of production will generally change over time. Prices and costs tend to rise with the general level of inflation in the economy.

7. **Plan:** The depreciation tax shield is equal to the depreciation expense multiplied by the tax rate.

$$\text{Execute: Depreciation tax shield} = \text{Depreciation expense} \times \text{Tax Rate} = \$450,000 \times 0.4 = \$180,000$$

Evaluate: Thus, each dollar of depreciation expense “shields” a dollar of income from tax. At a tax rate of 40% on a dollar of income, the total reduction in your taxes is \$180,000.

8. **Plan:** To calculate free cash flows from earnings, you need to add back depreciation and subtract the change in net working capital. Since net working capital will be decreasing, this is an *addition* to earnings (you are subtracting a negative change).

$$\text{Execute: } \$2,800,000 + \$500,000 - (-\$410,000) = \$3,710,000$$

Evaluate: Your forecasted free cash flows will differ from your pro forma earnings because of both the depreciation expense and the change in net working capital. The depreciation expense is not a real cash outflow, and the change in net working capital is an inflow that is not reflected in the earnings.

9. **Plan:** Set up the pro-forma income statement to calculate your pro forma earnings, then make adjustments to earnings to forecast free cash flows. In this case, your only adjustment is to add back the depreciation (not a real cash outflow) that was deducted from earnings.

Execute:

Sales	2,300,000
COGS	−980,000
Depreciation	−600,000

EBIT	720,000
Taxes (40%)	−216,000
Earnings	504,000

Add back depr. 600,000

FCF 1,104,000

Evaluate: Pro forma free cash flow will be 600,000 higher than pro forma earnings because of the depreciation expense.

10. **Plan:** The difference between incremental earnings and incremental free cash flows is driven by the equipment purchased. We need to recognize the cash outflow associated with the purchase in year 0 and add back the depreciation expenses from years 1 to 8, as they are not actually cash outflows.

Execute:

Free cash flows = After-tax earnings + depreciation − capital expenditures − changes in NWC

FCF (this year) = −\$8,070,000

FCF (for each of the next eight years) = 1,014,750 + 1,008,750 = \$2,023,500

Evaluate: By recognizing the outflow from purchasing the equipment in year 0, we account for the fact that \$8,070,000 left the firm at that time. By adding back the depreciation expenses in years 1 to 8, we adjust the incremental earnings to reflect the fact that the depreciation expense is not a cash outflow.



- 11. Plan:** We can project the net working capital needed for this operation by adding cash, inventory, and receivables and subtracting payables.

Execute: Net working capital in this problem is the sum of Cash, Accounts Receivable, and Inventory (Lines 1, 2, and 3 below) less Accounts Payable (Line 4). Line 5 is net working capital, and Line 6 is the changes in working capital from year to year. For example, net working capital in year 1 was 14, and in year 2, it grew to 19, so the increase in NWC, as computed on Line 6 for year 2, is 5. The firm must add 5 to working capital in year 2, so it represents a reduction in cash flow available to investors.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
1 Cash		6	12	15	15	15
2 Accounts Receivable		21	22	24	24	24
3 Inventory		5	7	10	12	13
4 Accounts Payable		18	22	24	25	30
5 Net Working Capital (1 + 2 + 3 - 4)	0	14	19	25	26	22
6 Increase in NWC		-14	-5	-6	-1	4

Evaluate: Most projects will require the firm to invest in net working capital. We care about net working capital because it reflects a short-term investment that ties up cash flow that could be used elsewhere. Note that whenever net working capital increases, reflecting additional investment in net working capital, it represents a reduction in cash flow that year.



- 12. Plan:** In order to compute the net working capital for each year, we need to compute the receivables and payables for each year as a percentage of sales and COGS (receivables are 15% of sales, and payables are 15% of COGS).

Execute:

	0	1	2	3	4
Sales		\$23,500	\$26,438	\$23,794	\$8566
COGS		\$ 9500	\$10,688	\$ 9619	\$3463
Receivables	\$0	\$ 3525	\$ 3966	\$ 3569	\$1285
Payables	\$0	\$ 1425	\$ 1603	\$ 1443	\$ 519
NWC	\$0	\$ 2100	\$ 2363	\$ 2126	\$ 765
Δ NWC (Required Investment)		\$ 2100	\$ 263	-\$ 236	-\$1364

Evaluate: Most projects will require the firm to invest in net working capital. We care about net working capital because it reflects a short-term investment that ties up cash flow that could be used elsewhere. Note that whenever net working capital increases, reflecting additional investment in net working capital, it represents a reduction in cash flow that year.



- 13. Plan:** We need four items to calculate incremental earnings: (1) incremental revenues, (2) incremental costs, (3) depreciation, and (4) the marginal tax rate.

Earnings include non-cash charges, such as depreciation, but do not include the cost of capital investment. To determine the project's free cash flow from its incremental earnings, we must adjust for these differences. We need to add back depreciation to the incremental earnings to recognize the fact that we still have the cash flow associated with it.

Execute:

Solution: Note—we have assumed any incremental cost of goods sold is included as part of operating expenses.

a.

	Year	1	2
Incremental Earnings Forecast (\$000s)			
1 Sales		125.0	160.0
2 Operating Expenses		(40.0)	(60.0)
3 Depreciation		(25.0)	(36.0)
4 EBIT		60.0	64.0
5 Income Tax at 35%		(21.0)	(22.4)
6 Unlevered Net Income		39.0	41.6

b.

		1	2
Free Cash Flow (\$000s)			
7 Plus: Depreciation		25.0	36.0
8 Less: Capital Expenditures		(30.0)	(40.0)
9 Less: Increases in NWC		(2.0)	(8.0)
10 Free Cash Flow		32.0	29.6

Evaluate: These incremental earnings are an intermediate step on the way to calculating the incremental cash flows that would form the basis of any analysis of the project. Earnings are an accounting measure of the firm's performance. They do not represent real profits, and a firm needs cash. Thus, to evaluate a capital budgeting decision, we must determine its consequences for the firm's available cash.

- 14. Plan:** Earnings include non-cash charges, such as depreciation, but do not include the cost of capital investment. To determine the project's free cash flow from its incremental earnings, we must adjust for these differences. We need to add back depreciation to the incremental earnings to recognize the fact that we still have the cash flow associated with it.

Execute: $FCF = \text{Unlevered Net Income} + \text{Depreciation} - \text{CapEx} - \text{Increase in NWC} = 250 + 100 - 200 - 10 = \140 million

Evaluate: Earnings are an accounting measure of the firm's performance. They do not represent real profits, and a firm needs cash. Thus, to evaluate a capital budgeting decision, we must determine its consequences for the firm's available cash.

15. This opportunity cost lowers the incremental earnings of Home net by the after-tax earnings that they would have otherwise earned had they rented out the space instead. This would be a decrease in incremental earnings of $200,000 \times (1 - 0.40) = \$120,000$ per year for the four years.



***16. Plan:**

Incremental revenues: 0

Incremental costs: $-150,000$

Depreciation: $\$10,000$ per year

Capital Gain on Salvage: $\$50,000 - \$0 = \$50,000$

Cash Flow from Salvage Value: $+50,000 - (50,000)(0.45) = 27,500$

Execute: Replacing the machine increases EBITDA by $40,000 - 20,000 = 20,000$.

Depreciation expenses rises by $\$15,000 - \$10,000 = \$5,000$. Therefore, FCF will increase by $(20,000) \times (1 - 0.45) + (0.45)(5,000) = \$13,250$ in years 1 through 10.

In year 0, the initial cost of the machine is $\$150,000$. Because the current machine has a book value of $\$110,000 - 10,000$ (one year of depreciation) $= \$100,000$, selling it for $\$50,000$ generates a capital gain of $50,000 - 100,000 = -50,000$. This loss produces tax savings of $0.45 \times 50,000 = \$22,500$, so that the after-tax proceeds from the sales including this tax savings is $\$72,500$. Thus, the FCF in year 0 from replacement is $-150,000 + 72,500 = -\$77,500$.

NPV of replacement $= -77,500 + 13,250 \times (1/0.10)(1 - 1/1.10^{10}) = \$3,916$. There is a small profit from replacing the machine.

Evaluate: Even though the decision has no impact on revenues, it still matters for cash flows because it reduces costs. Further, both selling the old machine and buying the new machine involve cash flows with tax implication.



- *17. Plan:** We can use Eq. 9.8 to evaluate the free cash flows associated with each alternative. Note that we only need to include the components of free cash flows that vary across each alternative. For example, because NWC is the same for each alternative, we can ignore it.

Execute: The spreadsheet below computes the relevant FCF from each alternative. Note that each alternative has a negative NPV—this represents the PV of the costs of each alternative. We should choose the one with the highest NPV (lowest cost), which in this case is purchasing the existing machine.

- a. See spreadsheet.

	0	1	2	3	4	5	6	7	8	9	10
Rent Machine											
1 Rent		(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)
2 FCF (rent)		(32,500)	(32,500)	(32,500)	(32,500)	(32,500)	(32,500)	(32,500)	(32,500)	(32,500)	(32,500)
3 NPV at 8%	(218,078)										
Purchase Current Machine											
4 Maintenance		(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)
5 Depreciation		21,429	21,429	21,429	21,429	21,429	21,429	21,429	—	—	—
6 Capital Expenditures	(150,000)										
7 FCF (purchase current)	(150,000)	(5,500)	(5,500)	(5,500)	(5,500)	(5,500)	(5,500)	(5,500)	(13,000)	(13,000)	(13,000)
8 NPV at 8%	(198,183)										

Continued

	0	1	2	3	4	5	6	7	8	9	10
Purchase Advanced Machine											
9 Maintenance		(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
10 Other Costs	(35,000)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
11 Depreciation		35,714	35,714	35,714	35,714	35,714	35,714	35,714	—	—	—
12 Capital Expenditures	(250,000)										
13 FCF (purchase advanced)	(272,750)	9,250	9,250	9,250	9,250	9,250	9,250	9,250	(3,250)	(3,250)	(3,250)
14 NPV at 8%	(229,478)										

b. See spreadsheet.

Evaluate: When evaluating a capital budgeting project, financial managers should make the decision that maximizes NPV. In this case, Beryl's Iced Tea should purchase the current machine because it has the lowest negative NPV.

- 18. Plan:** Identify the relevant incremental cash flows. The feasibility study is a sunk cost and so is irrelevant. The price you paid for the space two years ago is similarly irrelevant. However, the net amount you would receive if you sold the space today is an opportunity cost to using it for a coffee shop instead, so we recognize that as a cost (a forgone cash flow).

Execute:

Opp Cost −115,000

Cap Ex −30,000

Incr in NWC −5,000

FCF −150,000

Evaluate:

To properly represent the initial cash flow in your analysis, you need to ignore the sunk costs and recognize the opportunity costs as well as the long-term investment (capital expenditures) and short-term investments (increase in NWC).

- 19. Plan:** We need to know the book value of the machine at the time of the sale. Only the part of the selling price above or below book value will have a tax effect. The book value is the purchase price minus accumulated depreciation.

Execute:

Straight-line depreciation over a seven-year life yields annual depreciation expenses of $\$1,000,000/7 = \$142,857.14$.

Three years of depreciation means that the machine's book value is $\$1,000,000 - 3(\$142,857.14) = \$571,428.58$. Only the portion of the sale price that exceeds the book value is taxable, so you will owe taxes on $\$700,000 - \$571,428.58 = \$128,571.42$. At a tax rate of 35%, total taxes will be $\$128,571.42(0.35) = \$45,000.00$. So, your total incremental cash flow will be $\$700,000 - \$45,000 = \$655,000$.

Evaluate:

Even though you are selling the machine for \$700,000, the whole amount is not taxable—only the portion above its book value is taxable. After paying taxes of \$45,000, you would have a cash flow of \$655,000 from selling the machine.

- 20. Plan:** Compute the depreciation charges and the book value of the asset during each of the five years of its life. Then compute the after-tax proceeds if the asset is sold after three years.

Execute:

- a. The MACRS five-year schedule, along with the book value:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
MACRS Schedule:	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
Depreciation Charge:	\$ 60,000	\$ 96,000	\$57,600	\$34,560	34,560	17,280
Remaining Book Value:	\$240,000	\$144,000	\$86,400	\$51,840	17,280	0

- b. The profits on the sale would be $\$180,000 - \$51,840 = \$128,160$. The taxes on this profit would be $128,160 \times 0.35 = \$44,856$. Thus, the total after-tax proceeds from the sale are $\$180,000 - \$44,856 = \$135,144$.

Evaluate: The book value of the asset after three years would be \$51,840. If the assets were sold after three years for \$180,000, the firm would receive \$135,144 net of taxes.

- 21. Plan:** If the company accepts the order and does not sell the machine, determine the cost to the company.

Execute: Yes, the cost of taking the order is the lost \$135,144 in after-tax cash flow that it would have otherwise received by selling the equipment.

Evaluate: By taking the order and not selling the machine, the company is forgoing the \$135,144 it would have received from the sale of the machine. This is therefore a cost of taking the order.

- 22.** a. No, this is a sunk cost and will not be included directly. (But see part (f) below.)
 b. Yes, this is a cost of opening the new store.
 c. Yes, this loss of sales at the existing store should be deducted from the sales at the new store to determine the incremental increase in sales that opening the new store will generate for HBS.
 d. No, this is a sunk cost.
 e. This is a capital expenditure associated with opening the new store. These costs will therefore increase HBS's depreciation expenses.
 f. Yes, this is an opportunity cost of opening the new store. (By opening the new store, HBS forgoes the after-tax proceeds it could have earned by selling the property. This loss is equal to the sale price less the taxes owed on the capital gain from the sale, which is the difference between the sale price and the book value of the property. The book value equals the initial cost of the property less accumulated depreciation.)

g. Although these financing costs will affect HBS's actual earnings, for capital budgeting purposes we calculate the incremental earnings without including financing costs to determine the project's unlevered net income.

23. The incremental cash flows would increase in years 0 and 1, as the accelerated depreciation schedule would give Daily Enterprises a higher tax shield during those two years. In years 2 through 5, the incremental free cash flows would be lower because the depreciation expenses in these years is lower than 20%. Overall, the present value of the free cash flows would increase under a MACRS depreciation schedule.



24. a. \$15 million/5 years = \$3 million per year
b. \$3 million \times 35% = \$1.05 million per year
c.

	Year	0	1	2	3	4	5
MACRS Depreciation							
Equipment Cost		15,000					
MACRS Depreciation Rate		20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
Depreciation Expense		3,000	4,800	2,880	1,728	1,728	864
Depreciation Tax Shield (at 35% tax rate)		1,050	1,680	1,008	605	605	302

- d. In both cases, its total depreciation tax shield is the same. But with MACRS, it receives the depreciation tax shields sooner—thus, MACRS depreciation leads to a higher NPV of Markov's FCF.
e. If the tax rate will increase substantially, then Markov may be better off claiming higher depreciation expenses in later years because the tax benefit at that time will be greater.



25. Design already happened and is sunk (irrelevant).

According to the seven-year MACRS schedule, depreciation will be (in \$ 000s)

1	2	3	4	5	6	7	8
142.9	244.9	174.9	124.9	89.3	89.2	89.3	44.6

Which comes from multiplying the MACRS % by \$1 million for each year. In our analysis, the first year (year 1) of depreciation will be year 0 in our timeline.


Also, note that we are only concerned about *changes* in working capital.

	Without Project	Time: 0	1	2	3
Level	300	380	400	350	300
Change		80	20	-50	-50
Cash flow		-80	-20	+50	+50

	0	1	2	3
+Revenues		2,400	2,400	2,400
−Costs		800	800	800
−Depreciation	142.9	244.9	174.9	124.9
=Taxable Income	−142.9	1,355.1	1,425.1	1,475.1
−Tax (35%)	−50.01	−474.29	−498.79	−516.29
=Net Income	−92.89	880.82	926.32	958.82
+Add back Depr	142.9	244.9	174.9	124.9
+CapEx	−1000			312.4
+CF from Chg NWC	−80	−20	50	50
FCF	−1,029.99	1,105.72	1,151.22	1,446.12
NPV	\$2,013.12			

$$NPV = -1,029.99 + \frac{1,105.7}{1.10} + \frac{1,151.2}{(1.10)^2} + \frac{1,466.1}{(1.10)^3} = 2,013.12$$

It has an NPV of \$2,013.12 thousand, or \$2,013,115

-  **26.** The \$10 million spent on prototypes is sunk and irrelevant. According to the five-year depreciation schedule, depreciation of the \$60 million of equipment will be:

	1	2	3	4	5	6
MACRS schedule	0.2	0.32	0.192	0.1152	0.1152	0.0576
MACRS depreciation	12	19.2	11.52	6.912	6.912	3.456

Which comes from multiplying the MACRS % by \$60 million for each year. In our analysis, the first year (year 1) of depreciation will be year 0 in our timeline.

The fully depreciated (Book value = 0) equipment that could be sold for \$10 million represents an opportunity cost. If you sold it, you would have to pay taxes on the difference between the \$10 million and its book value (0), so you would have to pay $(0.35)(\$10 \text{ million}) = \3.5 million . Thus, by using the equipment, you are giving up $\$10 \text{ million} - \$3.5 \text{ million} = \$6.5 \text{ million}$ after-tax from selling the equipment. We will recognize this cost in year 0.


The overhead cost of the R&D center should not be included in the analysis because it is not an incremental cost created by this project. Another way of thinking about this is that the R&D center exists whether you go ahead with this project or not, so its costs are not created by going ahead with the project.

The last thing to note is that we are concerned with changes in working capital, not levels.

	Without Project	Time: 0	1	2	3	4	5
Level	120	140	140	140	140	140	120
Change		20	0	0	0	0	−20
Cash flow		−20	0	0	0	0	+20

	0	1	2	3	4	5
+ Revenues		450	450	450	450	450
– Expenses		–350	–350	–350	–350	–350
– Depreciation	12	–19.2	–11.52	–6.912	–6.912	–3.456
= Taxable Inc	–12	80.80	88.48	93.09	93.09	96.54
– Tax (35%)	–4.2	–28.28	–30.97	–32.58	–32.58	–33.79
= Net Income	–7.8	52.52	57.51	60.51	60.51	62.75
+ Depreciation	12	19.2	11.52	6.912	6.912	3.456
– Capital Expenditures	–60					
– Opportunity Cost	–6.5					
+ CF from Change in Working Capital	–20					20
= FCF	–82.30	71.72	69.03	67.42	67.42	86.21
NPV	\$158.00					

$$NPV = -82.3 + \frac{71.72}{(1.15)} + \frac{69.03}{(1.15)^2} + \frac{67.42}{(1.15)^3} + \frac{67.42}{(1.15)^4} + \frac{86.21}{(1.15)^5} = 158.0$$

 **27.** The \$10,000 on client development is sunk and irrelevant.

The fully depreciated (Book value = 0) equipment that could be sold for \$50,000 represents an opportunity cost. If you sold it, you would have to pay taxes on the difference between the \$50,000 and its book value (0), so you would have to pay $(0.35)(\$50,000) = \$17,500$. Thus, by using the equipment, you are giving up $\$50,000 - \$17,500 = \$32,500$ after tax from selling the equipment. We will recognize this cost in year 0.

According to the five-year depreciation schedule, depreciation of the \$30,000 of new equipment will be:

MACRS schedule	0.2	0.32	0.192	0.1152	0.1152	0.0576
MACRS depreciation	6,000	9,600	5,760	3,456	3,456	1,728

Which comes from multiplying the MACRS % by \$30,000 for each year. In our analysis, the first year (year 1) of depreciation will be year 0 in our timeline.

For the production manager, the key is to think about which salary is being incurred because of this project. You already have a production manager, and she is busy, so she would continue to work for you whether you start this new project or not. The only change that occurs because of this project is that you will need to hire an assistant. Thus, the current production manager's salary is not relevant to the analysis (it would be incurred whether you go forward with the project or not). The assistant's salary, however, is incremental with the project. We will include the assistant's salary expense in the analysis.

The last thing to note is that we are concerned with changes in working capital, not levels.

	Without Project	Time: 0	1	2	3	4	5
Level	20,000	30,000	30,000	30,000	30,000	30,000	30,000
Change		10,000	0	0	0	0	-10,000
Cash flow		-10,000	0	0	0	0	+10,000
		0	1	2	3	4	5
+ Revenues			200,000	200,000	200,000	200,000	200,000
– Expenses			-100,000	100,000	-100,000	-100,000	-100,000
– Salary			-40,000	-40,000	-40,000	-40,000	-40,000
– Depreciation		-6,000	-9,600	-5,760	-3,456	-3,456	-1,728
= Taxable Inc		-6,000	50,400	54,240	56,544	56,544	58,272
– Tax (35%)		2,100	-17,640	-18,984	-19,790.4	-19,790.4	-20,395.2
= Net Income		-3,900	32,760	35,256	36,753.6	36,753.6	37,876.8
+ Depreciation		6,000	9,600	5,760	3,456	3,456	1,728
– Capital Expenditures		-62,500					
+ CF from Change in Working Capital		-10,000	0	0	0	0	10,000
= FCF		-70,400	42,360.0	41,016.0	40,209.6	40,209.6	49,604.8
NPV		\$71,539.56					

$$NPV = -70,400 + \frac{42,360}{1.15} + \frac{41,016}{(1.15)^2} + \frac{40,209.6}{(1.15)^3} + \frac{40,209.6}{(1.15)^4} + \frac{49,604.8}{(1.15)^5} = 71,539.56$$

- 28. Plan:** The pro forma net income must be adjusted. Allocated overhead is sunk, depreciation should be added back, capital expenditures and changes in NWC must be recognized. Finally, it would be better to use MACRS instead of straight-line depreciation. Under MACRS, we take the percentage in the table for each year and multiply it by the original purchase price of the equipment to calculate the depreciation for that year.

Execute:

- a. Free Cash Flows are:

	0	1	2	...	9	10
= Net Income		4,875	4,875		4,875	48,75
+ Overhead (after tax at 35%)		650	650		650	650
+ Depreciation		2,500	2,500		2,500	2,500
– Capex	25,000					
– Inc. in NWC	10,000					-10,000
FCF	-35,000	8,025	8,025	...	8,025	18,025

$$\text{b. NPV} = -35 + 8.025 \times \frac{1}{0.14} \left(1 - \frac{1}{1.14^9} \right) + \frac{18.025}{1.14^{10}} = 9.557$$

Evaluate: The pro forma free cash flows are considerably different from the pro forma earnings. Also, compared with straight-line depreciation, the MACRS method allows for larger depreciation deductions earlier in the asset's life, which increases the present value of the depreciation tax shield and so will raise the project's NPV.



- 29. Plan:** Compute the Free Cash Flow forecast for the next 10 years. Compute the NPV of the project based on the forecasted Free Cash Flows. Then compute the NPV under different assumptions about Initial Sales and Growth. Then compute the NPV of the project under a range of discount rates.

	Year	0	1	2	3	4	5	6	7	8	9	10
Free Cash Flow Forecast												
(\$ millions)												
1 Sales	—	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2 Manufacturing	—	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)
3 Marketing Expenses	—	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)
4 Depreciation	—	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)
5 EBIT	—	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
6 Income Tax at 35%	—	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)
7 Unlevered Net Income	—	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
8 Depreciation	—	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
9 Inc. in NWC	—	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)
10 Capital Expenditures	(150.0)	—	—	—	—	—	—	—	—	—	—	—
11 Continuation Value	—	—	—	—	—	—	—	—	—	—	—	12.0
12 Free Cash Flow	(150.0)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	48.0
13 NPV at 12%	57.3	—	—	—	—	—	—	—	—	—	—	—

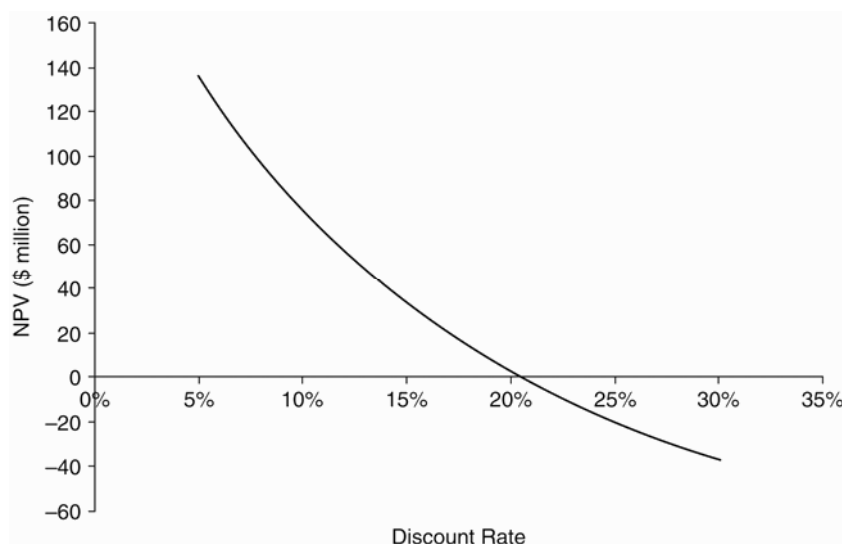
Execute:

- a. The NPV of the estimate free cash flow is:

$$\begin{aligned} \text{NPV} &= -150 + 36 \times \frac{1}{0.12} \left(1 - \frac{1}{1.12^9} \right) + \frac{48}{1.12^{10}} \\ &= \$57.3 \text{ million} \end{aligned}$$

b. Initial Sales:	90	100	110
NPV:	20.5	57.3	94.0
c. Growth Rate:	0%	2%	5%
NPV:	57.3	72.5	98.1

- d. NPV is positive for discount rates below the IRR of 20.6%.



Evaluate: Under the forecast assumptions, the project has an NPV of \$57.3 million and therefore should be accepted. Under various scenarios of assumed initial sales and growth the project continues to have a positive NPV, meaning that even if the forecast assumption proves too optimistic or pessimistic, the project will still create firm value. Finally, the discount rate used in the forecast assumptions is 12%, but the project would have a positive NPV using any discount rate below 20.6%. The project is positive and the results are robust.



- *30. a. See spreadsheet.
 b. See spreadsheet.
 c. See spreadsheet.
 d. See data tables in spreadsheet.
 e. See data tables in spreadsheet.
 f. See spreadsheet—need additional sales of \$11.384 million in years 3 to 10 for a larger machine to have a higher NPV than XC-750.

Incremental Effects
 (with vs. without XC-750)

Year	0	1	2	3	4	5	6	7	8	9	10	11
Sales Revenues	-5,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Cost of Goods Sold	3,500	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000	-7,000
S, G, & A Expenses		-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000
Depreciation		-275	-275	-275	-275	-275	-275	-275	-275	-275	-275	-275
EBIT	-1,500	725	725	725	725	725	725	725	725	725	725	725
Taxes at 35%	525	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254	-254
Unlevered Net Income	-975	471	471	471	471	471	471	471	471	471	471	471

**Incremental Effects
(with vs. without XC-750)**

Year	0	1	2	3	4	5	6	7	8	9	10	11
Depreciation		275	275	275	275	275	275	275	275	275	275	
Capital Expenditures	-2,750											
Add. to Net Work. Cap.	-600	-1,200	0	0	0	0	0	0	0	0	1,000	800
FCF	-4,325	-454	746	746	746	746	746	746	746	746	1,746	800
Cost of Capital	10.00%											
PV(FCF)	-4325	-413	617	561	510	463	421	383	348	316	673	280
NPV	-164.6											

Net Working Capital Calculation

Year	0	1	2	3	4	5	6	7	8	9	10	11
Receivables at 15%	-750	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	0
Payables at 10%	350	-700	-700	-700	-700	-700	-700	-700	-700	-700	-700	0
Inventory	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0	0
NWC	600	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	800	0

Sensitivity Analysis: New Sales

New Sales (000s)	8	9	10	10.143	11	12
NPV	-2,472	-1,318	-165	0	989	2,142

Sensitivity Analysis: Cost of Goods Sold

COGS	67%	68%	69.545%	69%	70%	71%
NPV	921	559	0	197	-165	-526

**Incremental Effects
(with vs. without XC-900)**

Year	0	1	2	3	4	5	6	7	8	9	10	11
Sales Revenues	-5,000	10,000	10,000	11,384	11,384	11,384	11,384	11,384	11,384	11,384	11,384	
Cost of Goods Sold	3,500	-7,000	-7,000	-7,969	-7,969	-7,969	-7,969	-7,969	-7,969	-7,969	-7,969	
S, G, & A Expenses		-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	-2,000	
Depreciation		-400	-400	-400	-400	-400	-400	-400	-400	-400	-400	
EBIT	-1,500	600	600	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	
Taxes at 35%	525	-210	-210	-355	-355	-355	-355	-355	-355	-355	-355	
Unlevered Net Income	-975	390	390	660	660	660	660	660	660	660	660	
Depreciation		400	400	400	400	400	400	400	400	400	400	
Capital Expenditures	-4,000											
Add. to Net Work. Cap.	-600	-1,200	0	-111	0	0	0	0	0	0	1,000	911
FCF	-5,575	-410	790	949	1,060	1,060	1,060	1,060	1,060	1,060	2,060	911

**Incremental Effects
(with vs. without XC-900)**

Year	0	1	2	3	4	5	6	7	8	9	10	11
Cost of Capital	10.00%											
PV(FCF)	-5,575	-373	653	713	724	658	598	544	494	450	794	319
NPV	0.0											

Net Working Capital Calculation

Year	0	1	2	3	4	5	6	7	8	9	10	11
Receivables at 15%	-750	1,500	1,500	1,708	1,708	1,708	1,708	1,708	1,708	1,708	1,708	0
Payables at 10%	350	-700	-700	-797	-797	-797	-797	-797	-797	-797	-797	0
Inventory	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0	0
NWC	600	1,800	1,800	1,911	1,911	1,911	1,911	1,911	1,911	1,911	911	0

New Sales						
	8	9	10	10.40	11	12
NPV	-652	-326	0	129	326	652

Cost of Goods Sold						
	67%	68%	68.76%	69.00%	70%	71%
NPV	1203	802	498	401	0	-401

31. Real options must have positive value because they are only exercised when doing so would increase the value of the investment. If exercising the real option would reduce value, managers can allow the option to go unexercised. Thus, having the option but not the obligation to act is valuable.
32. The XC-900 allows Billingham the option to expand production starting in year 3. If it would be beneficial to expand production, Billingham will increase production with the XC-900. If it

would be better if production remains the same, Billingham is under no obligation to utilize all of the XC-900 production capacity.

- 33.** This provides Billingham the option to abandon the investment.

Chapter 10

Stock Valuation: A Second Look

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

- Plan:** To compute FCF, deduct taxes from EBIT, add back depreciation, and account for any capital expenditures and changes in NWC.

Execute:

EBIT	10
–Taxes	–3.5
=Net Income	6.5
Add back Depr	1
–Cap Ex	–1.5
–Chg NWC	–0.5
= FCF	5.5

Evaluate: Being able to calculate and forecast FCF is essential as an input in a discounted free cash flow model.

- Plan:** First, compute FCF using Eq. 9.6 and then apply the growing perpetuity formula ($r = 0.10$, $g = 0.04$) to calculate the value of the firm as the present value of its free cash flows.

Execute:

FCF next year is $EBIT(1 - \text{Tax Rate}) + \text{Depreciation} - \text{CapEx} - \text{Change in NWC} = \$1,000,000(1 - 0.40) + \$300,000 - \$300,000 - \$50,000 = \$550,000$.

Because depreciation will always equal capital expenditures, they will always cancel each other out, and so we can ignore them. Both EBIT and the change in NWC are expected to increase at a rate of 4%, so the overall FCF will also increase at a rate of 4%. Using the Discounted FCF model (note that the \$550,000 is for next year and does not need to be multiplied by $1 + \text{growth rate}$):

$$V_0 = \frac{\$550,000}{(0.10 - 0.04)} = \$9,166,666.67$$

Evaluate: The value of the firm today must be the present value of its expected free cash flows. For this firm, a good estimate of its value today is \$9,166,666.67.

- 3. Plan:** Use Eq. 10.4 to calculate the equity value and divide it by the number of shares outstanding, yielding the price per share.

Execute:

$$\text{By Eq. 10.4: } P_0 = \frac{V_0 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{100 + 6 - 30}{2} = 38$$

\$38 per share.

Evaluate: The firm has an enterprise value of \$100 million, but \$30 million of that is debt, and so must be subtracted before computing the equity value. Also, the firm has \$6 million in cash, which belongs to the equity holders, so it must be added.

- 4. Plan:** Use Eq. 10.3 to calculate the enterprise value and then Eq. 10.4 to calculate the price per share.

Execute:

$$\text{By Eq. 10.3, enterprise value equals the PV of future FCF: } V_0 = \frac{10}{0.11 - 0.03} = 125$$

$$\text{By Eq. 10.4, } P_0 = \frac{V_0 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{125 + 1 - 0}{5} = 25.2$$

\$25.20 per share.

Evaluate: Given the information, the enterprise value can be estimated as \$125 million, and in addition the firm has \$1 million in cash but no debt. The price per share should be \$25.20.



- 5. Plan:** The first step is to determine the value of Heavy Metal Corporation. Because the firm has specific cash flow estimates for years 1 to 5, these must be discounted to the present. Starting in year 6, the firm's cash flows are expected to grow at 4%, so they can be valued using the dividend growth model. Once the value of the entire firm is estimated, the second step is to determine the value of a share of equity.

Execute:

- a. $V(5) = 82 \times (1.04)/(14\% - 4\%) = \852.80 which is the value of the constant growth in dividends which starts in year 6.

$$V(0) = 53/1.14 + 68/1.14^2 + 78/1.14^3 + 75/1.14^4 + (82 + 852.8)/1.14^5 = \$681.37$$

which is the value of the entire firm at time 0.

- b. $P = (681 + 0 - 300)/40 = \9.53 is the value per share of equity. This is the value of the entire firm, minus the value of debt, divided by the number of shares outstanding.

Evaluate: The entire firm is worth \$681 million dollars. The equity of the firm is worth the entire firm value less the value of the outstanding debt (\$681 million minus \$300 million) or \$381 million. We now divide the value of the equity by the number of outstanding shares (\$381 million divided by 40 million) to determine a per share value of \$9.53.



- 6. Plan:** Use Eqs. 10.3 and 10.4 to compute the enterprise value and then price per share of Covan. At any point in time, the enterprise value is the PV of the remaining expected FCF. Once the two prices per share are computed, you can calculate the return.

Execute:

$$a. \quad V_0 = \frac{10}{1.12} + \frac{12}{1.12^2} + \frac{13}{1.12^3} + \frac{14}{1.12^4} + \left(\frac{1}{1.12^4} \right) \left(\frac{14(1.04)}{0.12 - 0.04} \right) = 152.31$$

$$P_0 = \frac{V_0 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{152.31 + 3 - 0}{8} = 19.41$$

- b. At any point in time, the enterprise value is still the PV of all remaining FCF:

$$V_0 = \frac{12}{1.12^1} + \frac{13}{1.12^2} + \frac{14}{1.12^3} + \left(\frac{1}{1.12^3} \right) \left(\frac{14(1.04)}{0.12 - 0.04} \right) = 160.59$$

$$P_0 = \frac{V_0 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{160.59 + 3 - 0}{8} = 20.45$$

$$c. \quad r = \frac{20.45 - 19.41}{19.41} = 0.054$$

Evaluate: Given your forecast of Covan's FCFs and its investment plans, you expect the stock price to rise from \$19.41 to \$20.54, giving you a return of 5.4%.



- 7. Plan:** The plan is to compute numerous calculations using the spreadsheet information provided in the problem.

Execute:

$$a. \quad V(3) = 33.3 / (10\% - 5\%) = 666$$

$$V(0) = 25.3 / 1.10 + 24.6 / 1.10^2 + (30.8 + 666) / 1.10^3 = 567$$

$$P(0) = (567 + 40 - 120) / 60 = \$8.11$$

Sora Industries has forecast cash flows for years 1, 2, and 3. After year 3, cash flows are forecast to grow at 5% per year. The total value of the firm is \$567 million, which is the present value of the forecast cash flows in years 1, 2, and 3, as well as the present value of the cash flows, starting in year 4, which will grow at 5% per year.

The value of a single share of Sora stock is \$8.11, which is the sum of the value of the firm (\$567) plus the value of the cash holdings (\$40) minus the value of the outstanding debt (\$120) divided by the number of outstanding shares, 60 million.

b. Free cash flows change as follows:

	Year	0	1	2	3	4	5
Earnings Forecast (\$000s)			8%	10%	6%	5%	5%
1 Sales		433.00	468.00	516.00	546.96	574.31	603.02
2 Cost of Goods Sold			(327.60)	(361.20)	(382.87)	(402.02)	(422.12)
3 Gross Profit			140.40	154.80	164.09	172.29	180.91
4 Selling, General, & Admin.			(93.60)	(103.20)	(109.39)	(114.86)	(120.60)
5 Depreciation			(7.00)	(7.50)	(9.00)	(9.45)	(9.92)
6 EBIT			39.80	44.10	45.70	47.98	50.38
7 Income Tax at 40%			(15.92)	(17.64)	(18.28)	(19.19)	(20.15)
8 Unlevered Net Income			23.88	26.46	27.42	28.79	30.23
Free Cash Flow (\$000s)							
9 Plus: Depreciation			7.00	7.50	9.00	9.45	9.92
10 Less: Capital Expenditures			(7.70)	(10.00)	(9.90)	(10.40)	(10.91)
11 Less: Increases in NWC			(6.30)	(8.64)	(5.57)	(4.92)	(5.17)
12 Free Cash Flow			16.88	15.32	20.94	22.92	24.07

Hence $V(3) = 458$, and $V(0) = 388$. Thus, $P(0) = \$5.13$.

c. New FCF:

	Year	0	1	2	3	4	5
Earnings Forecast (\$000s)			8%	10%	6%	5%	5%
1 Sales		433.00	468.00	516.00	546.96	574.31	603.02
2 Cost of Goods Sold			(313.56)	(345.72)	(366.46)	(384.79)	(404.03)
3 Gross Profit			154.44	170.28	180.50	189.52	199.00
4 Selling, General, & Admin.			(74.88)	(82.56)	(87.51)	(91.89)	(96.48)
5 Depreciation			(7.00)	(7.50)	(9.00)	(9.45)	(9.92)
6 EBIT			72.56	80.22	83.98	88.18	92.59
7 Income Tax at 40%			(29.02)	(32.09)	(33.59)	(35.27)	(37.04)
8 Unlevered Net Income			43.54	48.13	50.39	52.91	55.55
Free Cash Flow (\$000s)							
9 Plus: Depreciation			7.00	7.50	9.00	9.45	9.92
10 Less: Capital Expenditures			(7.70)	(10.00)	(9.90)	(10.40)	(10.91)
11 Less: Increases in NWC			(6.30)	(8.64)	(5.57)	(4.92)	(5.17)
12 Free Cash Flow			36.54	36.99	43.92	47.04	49.39

Now, $V(3) = 941$, $V(0) = 804$, $P(0) = \$12.07$.

*d. Inc. in NWC in yr 1 = 12% Sales(1) – 18% Sales(0).

Inc. in NWC in later years = 12% × change in sales.

New FCF:

	Year	0	1	2	3	4	5
Earnings Forecast (\$000s)			8%	10%	6%	5%	5%
1 Sales	433.00	468.00	516.00	546.96	574.31	603.02	
2 Cost of Goods Sold		(313.56)	(345.72)	(366.46)	(384.79)	(404.03)	
3 Gross Profit		154.44	170.28	180.50	189.52	199.00	
4 Selling, General & Admin.		(93.60)	103.20)	(109.39)	(114.86)	(120.60)	
6 Depreciation		(7.00)	(7.50)	(9.00)	(9.45)	(9.92)	
7 EBIT		53.84	59.58	62.10	65.21	68.47	
8 Income tax at 40%		(21.54)	(23.83)	(24.84)	(26.08)	(27.39)	
9 Unlevered Net Income		32.30	35.75	37.26	39.13	41.08	
Free Cash Flow (\$000s)							
10 Plus: Depreciation		7.00	7.50	9.00	9.45	9.92	
11 Less: Capital Expenditures		(7.70)	(10.00)	(9.90)	(10.40)	(10.91)	
12 Less: Increases in NWC		21.78	(5.76)	(3.72)	(3.28)	(3.45)	
13 Free Cash Flow		53.38	27.49	32.65	34.90	36.64	

Now $V(3) = 698$, $V(0) = 620$, $P(0) = \$9.00$.

Evaluate: An understanding of financial data allows the financial analyst to take information presented by a company and transform it in numerous ways to assist in financial analysis and decision making.



8. Plan: Value Nike under various assumptions of growth rate and discount rates.

Execute:

a. \$46.89 to \$51.53

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,071.0	28,857.7	30,646.9	32,424.4	34,175.3	35,884.1	WACC	10.0%
4 Growth Verses Prior Year		7.0%	6.6%	6.2%	5.8%	5.4%	5.0%		
5 EBIT (10% of Sales)		2,707.1	2,885.8	3,064.7	3,242.4	3,417.5	3,588.4	Margin	10%
6 Less Income Tax (24%)		649.7	692.6	735.5	778.2	820.2	861.2		
7 Plus: Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		177.1	178.7	178.9	177.8	175.1	170.9		
10 Free Cash Flow		1,880.3	2,014.5	2,150.2	2,286.5	2,422.2	2,556.3	53,682.6	< Future Cash Flows
		1.10	1.21	1.33	1.46	1.61	1.77	1.77	< Discount Factor
		1709.36	1664.889	1615.51	1561.711	1504.015	1442.972	30302.40376	< Discounted CFs
								\$39,800.9	< Sum of DCFs
								\$46.89	< Implied Stock Price

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	28,083.0	30,835.1	33,487.0	35,965.0	38,194.8	40,104.6	WACC	10.0%
4 Growth Verses Prior Year		11.0%	9.8%	8.6%	7.4%	6.2%	5.0%		
5 EBIT (10% of Sales)		2,808.3	3,083.5	3,348.7	3,596.5	3,819.5	4,010.5	Margin	10%
6 Less Income Tax (24%)		674.0	740.0	803.7	863.2	916.7	962.5		
7 Plus: Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		278.3	275.2	265.2	247.8	223.0	191.0		
10 Free Cash Flow		1,856.0	2,068.3	2,279.8	2,485.5	2,679.8	2,857.0	59,996.4	< Future Cash Flows
		1.10	1.21	1.33	1.46	1.61	1.77	1.77	< Discount Factor
		1687.28	1709.303	1712.867	1697.654	1663.959	1612.686	33866.41649	< Discounted CFs
								\$43,950.2	< Sum of DCFs
								\$51.53	< Implied Stock Price

b. \$45.18 to \$55.50

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,830.0	30,334.7	32,761.5	35,054.8	37,158.1	39,016.0	WACC	10.0%
4 Growth Verses Prior Year		10.0%	9.0%	8.0%	7.0%	6.0%	5.0%		
5 EBIT (10% of Sales)		2,504.7	2,730.1	2,948.5	3,154.9	3,344.2	3,511.4	Margin	9%
6 Less Income Tax (24%)		601.1	655.2	707.6	757.2	802.6	842.7		
7 Plus: Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		253.0	250.5	242.7	229.3	210.3	185.8		
10 Free Cash Flow		1,650.6	1,824.4	1,998.2	2,168.4	2,331.3	2,482.9	52,140.9	< Future Cash Flows
		1.10	1.21	1.33	1.46	1.61	1.77	1.77	< Discount Factor
		1500.52	1507.788	1501.283	1481.058	1447.543	1401.533	29432.20216	< Discounted CFs
								\$38,271.9	< Sum of DCFs
								\$45.18	< Implied Stock Price

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,830.0	30,334.7	32,761.5	35,054.8	37,158.1	39,016.0	WACC	10.0%
4 Growth Verses Prior Year		10.0%	9.0%	8.0%	7.0%	6.0%	5.0%		
5 EBIT (10% of Sales)		3,061.3	3,336.8	3,603.8	3,856.0	4,087.4	4,291.8	Margin	11%
6 Less Income Tax (24%)		734.7	800.8	864.9	925.4	981.0	1,030.0		
7 Plus: Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		253.0	250.5	242.7	229.3	210.3	185.8		
10 Free Cash Flow		2,073.6	2,285.5	2,496.2	2,701.2	2,896.1	3,075.9	64,594.8	< Future Cash Flows
		1.10	1.21	1.33	1.46	1.61	1.77	1.77	< Discount Factor
		1885.08	1888.852	1875.418	1844.99	1798.241	1736.291	36462.10258	< Discounted CFs
								\$47,491.0	< Sum of DCFs
								\$55.50	< Implied Stock Price

c. \$36.44 to \$55.75

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,830.0	30,334.7	32,761.5	35,054.8	37,158.1	39,016.0	WACC	12.0%
4 Growth Verses Prior Year		10.0%	9.0%	8.0%	7.0%	6.0%	5.0%		
5 EBIT (10% of Sales)		2,783.0	3,033.5	3,276.1	3,505.5	3,715.8	3,901.6	Margin	10%
6 Less Income Tax (24%)		667.9	728.0	786.3	841.3	891.8	936.4		
7 Plus Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		253.0	250.5	242.7	229.3	210.3	185.8		
10 Free Cash Flow		1,862.1	2,055.0	2,247.2	2,434.8	2,613.7	2,779.4	41,691.4	< Future Cash Flows
		1.12	1.25	1.40	1.57	1.76	1.97	1.97	< Discount Factor
		1662.571	1638.207	1599.509	1547.38	1483.075	1408.142	21122.13547	< Discounted CFs
								\$30,461.0	< Sum of DCFs
								\$36.44	< Implied Stock Price

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,830.0	30,334.7	32,761.5	35,054.8	37,158.1	39,016.0	WACC	9.5%
4 Growth Verses Prior Year		10.0%	9.0%	8.0%	7.0%	6.0%	5.0%		
5 EBIT (10% of Sales)		2,783.0	3,033.5	3,276.1	3,505.5	3,715.8	3,901.6	Margin	10%
6 Less Income Tax (24%)		667.9	728.0	786.3	841.3	891.8	936.4		
7 Plus Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		253.0	250.5	242.7	229.3	210.3	185.8		
10 Free Cash Flow		1,862.1	2,055.0	2,247.2	2,434.8	2,613.7	2,779.4	64,853.2	< Future Cash Flows
		1.10	1.20	1.31	1.44	1.57	1.72	1.72	< Discount Factor
		1700.53	1713.865	1711.584	1693.607	1660.285	1612.39	37622.42376	< Discounted CFs
								\$47,714.7	< Sum of DCFs
								\$55.75	< Implied Stock Price

d. By changing parameters you get prices from \$30.69 to \$62.98.

To get to the lowest stock price of \$30.69, the initial growth was set at the low of 7%, the EBIT margin was set at the low of 9%, and the WACC was set at the high of 12%. To get to the high stock price of \$62.98, the initial growth was set at the high of 11%, the EBIT margin was set at the high of 11%, and the WACC was set at the low of 9.5%.

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$million)									
3 Sales	25,300.0	27,071.0	28,857.7	30,646.9	32,424.4	34,175.3	35,884.1	WACC	12.0%
4 Growth Verses Prior Year		7.0%	6.6%	6.2%	5.8%	5.4%	5.0%		
5 EBIT (10% of Sales)		2,436.4	2,597.2	2,758.2	2,918.2	3,075.8	3,229.6	Margin	9%
6 Less Income Tax (24%)		584.7	623.3	662.0	700.4	738.2	775.1		
7 Plus Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		177.1	178.7	178.9	177.8	175.1	170.9		
10 Free Cash Flow		1,674.6	1,795.2	1,917.3	2,040.1	2,162.5	2,283.6	34,253.9	< Future Cash Flows
		1.12	1.25	1.40	1.57	1.76	1.97	1.97	< Discount Factor
		1495.14	1431.12	1364.716	1296.505	1227.06	1156.939	17354.09191	< Discounted CFs
								\$25,325.6	< Sum of DCFs
								\$30.69	< Implied Stock Price

1 Year	2012	2013	2014	2015	2016	2017	2018		
2 FCF Forecast (\$ million)									
3 Sales	25,300.0	28,083.0	30,835.1	33,487.0	35,965.0	38,194.8	40,104.6	WACC	9.5%
4 Growth Versus Prior Year		11.0%	9.8%	8.6%	7.4%	6.2%	5.0%		
5 EBIT (10% of Sales)		3,089.1	3,391.9	3,683.6	3,956.1	4,201.4	4,411.5	Margin	11%
6 Less Income Tax (24%)		741.4	814.0	884.1	949.5	1,008.3	1,058.8		
7 Plus Depreciation		--	--	--	--	--	--		
8 Less Capital Expenditures		--	--	--	--	--	--		
9 Less Increases in NWC (10% of Sales)		278.3	275.2	265.2	247.8	223.0	191.0		
10 Free Cash Flow		2,069.4	2,302.6	2,534.3	2,758.9	2,970.1	3,161.8	73,774.6	< Future Cash Flows
		1.10	1.20	1.31	1.44	1.57	1.72	1.72	< Discount Factor
		1889.898	1920.397	1930.28	1918.999	1886.692	1834.194	42797.85034	< Discounted FCFs
								\$54,178.3	< Sum of FCFs
								\$62.98	< Implied Stock Price

Evaluate: There is a range of values for Nike based on the growth rate and discount rate that is assumed. Frequently, a financial analyst will not work with a single assumed input (i.e., a growth rate) but with a range of inputs to observe a range of estimates of value.

9. **Plan:** If Kroger and Safeway are sufficiently similar companies, then they should be valued similarly by the stock market. So, if Safeway's price is 13 times its forward earnings, so should Kroger's be.

Execute:

Kroger: $13 \times \$3 = \39

Evaluate: If Kroger had the same P/E (22.103) as Safeway, Kroger's stock should sell for \$39 per share.

10. **Plan:** All three companies are in the same industry, but it is critical when using multiples that the companies be truly comparable. Jones does not have the size or the breadth of product line that Coca-Cola and Pepsi do, so the better choice is to use Coca-Cola's information to value Pepsi.

Evaluate: Coca-Cola has a price of 41.09 and an EPS of 1.89, giving it a P/E of $41.09/1.89 = 21.74$. Applying that multiple to Pepsi's EPS results in a price of $21.74 \times \$3.90 = \84.79 .

11. **Plan:** You can use the EV/EBITDA ratio to estimate the enterprise value and then use Eq 10.4 to calculate the price per share based on that estimate.

Execute:

Using the EV/EBITDA ratio, you estimate CSH's enterprise value as $\$5 \text{ million} \times 9 = \45 million .

$$P_0 = \frac{V_0 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{45,000,000 + 2,000,000 - 10,000,000}{800,000} = 46.25$$

Evaluate: Based on an EV/EBITDA ratio of 9, you would estimate a price of \$46.25. This price estimate is only valid if the ratio is a reasonable one for CSH.

- 12. Plan:** first, calculate the price as the PV of its dividend stream and then use that price to compute the P/E ratio using the expected earnings.

Execute: $\text{Price} = \text{PV} = \frac{3}{0.12 - 0.04} = 37.50$

Now calculate the forward P/E ratio: $\$37.50 / \$5.00 = 7.5$

Evaluate: Based on your expectations about next year's dividends, the dividend growth rate, and next year's earnings, the stock's P/E ratio is 7.5.

- 13. Plan:** We can use the payout ratio to compute the dividend and then use that dividend to value the stock using the growing perpetuity formula.

Execute: A payout ratio of 50% from earnings per share of \$6 implies a dividend of \$3. We can then value the stock as the PV of its growing perpetuity of dividends:

$$\text{Price} = \text{PV} = \frac{\$3}{0.11 - 0.05} = \$50$$

Evaluate: The price that is consistent with your growth expectations and GHL's cost of equity is \$50.

- 14. Plan:** The price is the present value of the growing perpetuity of dividends. The expected value of the next dividend can be expressed as the payout ratio multiplied by the forward expected earnings.

Execute:

$$\text{Price} = \frac{\text{Earnings} \times \text{Payout Ratio}}{r - g}, \text{ so } \frac{\text{Price}}{\text{Earnings}} = \frac{\text{Payout Ratio}}{r - g}$$

$$\text{In this case, we have } 12 = \frac{0.40}{0.13 - g}, \text{ solving for } g, \text{ we get } g = 0.09667.$$

Evaluate: If you assume that dividends follow a growing perpetuity, then there has to be relation between the P/E ratio and the underlying growth rate. In this case, the P/E ratio implies a growth rate of 9.667%.

- 15. Plan:** For the EV/EBITDA multiples, the equity value based on each comp can be computed as $(\text{EV/EBITDA}) \times \text{EBITDA} + \text{Cash} - \text{Debt}$.

Execute:

	Comp 1	Comp 2	Comp 3	Comp 4
EV/EBITDA	12	11	12.5	10
P/E	19	18	20	17
Equity Value = $(\text{EV/EBITDA} \times 300) + 30 - 40$	3590	3290	3740	2990
=Equity Value/100	35.9	32.9	37.4	29.9
=P/E $\times 2$	38	36	40	34

The range consistent with both sets would be \$34.00 to \$37.40. This includes the smallest value that is within both the P/E and EV/EBITDA ranges (\$34) and the highest value within both ranges (\$37.40).

Evaluate: There is no reason to expect different multiples to produce completely consistent estimates. In this case, one produces estimates from 29.90 to 37.40, and the other produces estimates from 34 to 40.

- 16. Plan:** Compute various estimates of the value of a share of Nike.

Execute:

- Average P/E ratio is 29.84. Multiplied by EPS of \$2.52 gives \$75.20.
- Range of \$28.88 ($\2.52×11.46) to \$177.81 ($\2.52×70.56).
- Average P/B ratio is 2.44. Multiplied by Book equity of \$12.48 per share gives \$30.45.
- Range of \$11.11 ($\12.48×0.89) to \$51.54 ($\12.48×4.13).

- 17. a.** Average EV/Sales is 1.12. Multiply by \$25,313 million in sales to get an estimate of Nike's EV. Add excess cash, subtract debt, and divide by shares outstanding:

$$P = \frac{\$25,313(1.12) + \$3337 - \$1390}{893.6} = \$33.91$$

- b. Range of \$18.61 to \$51.47:

$$P = \frac{\$25,313(0.58) + \$3337 - \$1390}{893.6} = \$18.61$$

$$P = \frac{\$25,313(1.74) + \$3337 - \$1390}{893.6} = \$51.47$$

- c. Average EV/EBITDA is 9.76. Multiply by \$3,254 million EBITDA to get an estimate of Nike's EV. Add excess cash, subtract debt, and divide by shares outstanding:

$$P = \frac{\$3254(9.76) + \$3337 - \$1390}{893.6} = \$37.72$$

d. Range of \$25.63 to \$68.31.

$$P = \frac{\$3,254(6.44) + \$3,337 - \$1,390}{893.6} = \$25.63$$

$$P = \frac{\$3,254(18.16) + \$3,337 - \$1,390}{893.6} = \$68.31$$

- *18. Plan:** Estimate the values of the stocks of Rocky Shoes and Boots and Deckers Outdoor Corporation using comparable price to earnings ratios (P/E) and the enterprise value to EBITDA multiple.

Execute:

Using P/E ratio:

$$\begin{aligned} 2.30 \times 13.3 &= 30.59 \text{ per share} \times 5.4 \text{ million shares} \\ &= \$165.2 \text{ million} \end{aligned}$$

Using Entity to EBITDA ratio:

$$\begin{aligned} 30.7 \text{ million} \times 7.4 &= 227.2 \text{ million} - 125 \text{ million debt} \\ &= \$102.2 \text{ million} \end{aligned}$$

Evaluate: Because the two firms have different levels of debt in their capital structure, the Entity to EBITDA valuation method is likely to be more accurate.

- 19. Plan:** Compute the values of Summit Systems as required in the problem.

Execute:

$$\text{Price before news: } P = \frac{\$1.50}{0.11 - 0.06} = \$30$$

$$\text{Price after news: } P = \frac{\$1.50}{0.11 - 0.03} = \$18.75$$

- Price drops by \$11.25 per share (\$30.00 – \$18.75).
- You would likely be able to sell for no more than \$18.75 because an efficient market would incorporate the news into the stock price immediately.

Evaluate: The value of a share of Summit Systems with a 3% growth rate is \$18.75. Once the information about the revised growth rate for Summit Systems reaches the capital market, it will be quickly and efficiently reflected in the stock price.

- 20. Plan:** Compute Cola's stock price and future dividend growth rate.

Execute:

a. $P = 1.24 / (8\% - 7\%) = \124

- b. Based on the market price, our growth forecast is probably too high. Growth rate consistent with market price is

$$g = r_E - \text{div yield} = 8\% - 1.24/43 = 5.12\%$$

which is more reasonable.

Evaluate: Assuming a 7% annual growth rate in dividends, Cola Company common shares should sell for \$124. Given that they actually sell for \$43, it is obvious that investors, as a group, are only expecting a **dividend** growth rate of 5.12%. Given that the market expectation of 5.12% growth is the consensus forecast of all investors, it is likely more reasonable.

- 21. Plan:** Calculate the drop in value of Roybus, Inc. equity shares because of the fire in Taiwan. Would you expect to make a profit in trading Roybus shares based on information about the fire?

Execute:

- a. $PV(\text{change in FCF}) = -180/1.13 - 60/1.13^2 = -206$.
Change in $V = -206$, so if debt value does not change, P drops by $206/35 = \$5.89$ per share.
- b. If this is public information, in an efficient market the share price will drop immediately to reflect the news, and no trading profit is possible.

Evaluate: After news of the fire becomes known, we would expect Roybus shares to drop by \$5.89 per share. We would also expect the capital market to reduce the value of Roybus shares quickly and efficiently so that profiting from this announcement by trading Roybus shares would not be a profitable strategy.

- *22. Plan:** The stock price should represent the unbiased assessment of success versus failure, so you can back-out the market's expectation of success.

Execute:

- a. The market seems to assess a somewhat greater than 50% chance of success because good news would produce a price of \$70 and bad news would produce a price of \$18. Good news seems more likely.
- b. Yes, if they have better information than other investors.
- c. Market may be illiquid—no one wants to trade if they know Kliner has better information. Kliner's trades will move prices significantly, limiting profits.

Evaluate: Only if Kliner is able to get better information than the market's *and* was able to trade on that information, would it be able to profit.

- 23. Plan:** The transaction costs will reduce your dollar gains, reducing your return. The total commission is the commission per trade times the number of trades.

Execute:

Trading each stock five times results in a total of 75 trades. The total commission cost is $75 \times \$30 = \2250 .

With a 12% return, your dollar return on the portfolio before trading costs is $\$100,000(0.12) = \$12,000$. Subtracting trading costs, your net dollar return is $\$12,000 - \$2,250 = \$9,750$ and your net percentage return is $\$9,750/\$100,000 = 9.75\%$. Trading costs reduced your return by 2.25%.

Evaluate: Unless you have special information, trading is costly without increasing your expected return, and so ends up as a net loss relative to buy-and-hold.

- 24. Plan:** Compare the FV of the investments.

Execute:

$$100,000(1.12)^{10} = 310,584.82$$

$$100,000(1.18)^{10} = 523,383.56$$

The difference is 212,798.73.

Evaluate: The difference in returns compounds so that even over only 10 years, the cost is substantial.

Chapter 11

Risk and Return in Capital Markets

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Compute the realized return on this equity investment.

Execute:

$$R = \frac{2 + (95 - 80)}{80} = 21.25\%$$

Evaluate: The realized return on the equity investment is 21.25%.

2. **Plan:** Split the realized return into the dividend and capital gain yields.

Execute:

$$R_{\text{div.}} = 2/80 = 2.5\%$$
$$R_{\text{capital gain}} = (95 - 80)/80 = 18.75\%$$

Evaluate: The dividend yield is 2.5% and the capital gain yield is 18.75%, thus the bulk of the return came from price appreciation.

3. **Plan:** Compute the capital gain and dividend yield under the assumption that the stock price has fallen to \$68.

Execute:

- a. New $r_{\text{capital gain}} = (68 - 80)/80 = -15\%$

Yes, the capital gain is different, because the difference between the current price and the purchase price is different than in Problem 1.

- b. The dividend yield does not change, because the dividend is the same as in Problem 1.

Evaluate: Thus, the capital gain changes with the new lower price; the dividend yield does not change.

4. a. Your investment in CSH is $100 \times \$20 = \$2,000$; in EJH it is $50 \times \$30 = \$1,500$, so your total investment is \$3,500. Your weights are $2,000/3,500 = 0.57$ and $1,500/3,500 = 0.43$.

- b. There are two ways to calculate this. You can either compute the return on each stock and multiply those returns by their weights, or you can compute the total change in the value of your portfolio:

CSH: $(23 - 20)/20 = 0.15$; EJH: $(29 - 30)/30 = -0.033$, so the return on your portfolio is:

$$(0.57)(0.15) + (0.43)(-0.033) = 0.071$$

Or: your investment in CSH goes from \$2,000 to \$2,300 and in EJH goes from \$1,500 to \$1,450. Your portfolio has a net gain of $\$300 - \$50 = \$250$. As a return, that is $\$250 / \$3,500 = 0.071$

[NOTE: the calculations would always yield exactly the same answer unless you round during the process]

5. **Plan:** Compute the future sale price that is necessary to produce a 12% return.

Execute:

$$\frac{1.5 + (P_1 - 35)}{35} = 0.12$$

$$(P_1 - 35) = 4.2 - 1.5$$

$$P_1 = 37.7$$

Evaluate: Thus, the selling price immediately after the dividend would need to be 37.7 for you to earn a 12% return on the investment.

6. **Plan:** Compute each period's return as the price change + dividend divided by the initial price (see Eq. 11.1). Then compute the annual realized return as the product of $1 +$ each period's return and then subtract off the 1 (see Eq. 11.2):

Execute:

$$R_1 = \frac{23 - 22 + 2}{22} = \frac{3}{22} = 0.136 \quad R_2 = \frac{24.5 - 23 + 2}{23} = \frac{3.5}{23} = 0.152$$

$$R_3 = \frac{25.1 - 24.5 + 2}{24.5} = \frac{2.6}{24.5} = 0.106 \quad R_4 = \frac{22.5 - 25.1 + 2}{25.1} = \frac{-0.6}{25.1} = -0.024$$

$$R = (1 + 0.136)(1 + 0.152)(1 + 0.106)(1 - 0.024) - 1 = 1.413 - 1 = 0.413$$

Evaluate: In this case, the annual realized return is the compound return of the quarterly returns, taking into account both the dividends and price changes.



7.

Date	Price	Dividend	R	1+R
1/2/2008	86.62			
2/6/2008	79.91	0.4	-7.28%	0.92715308
5/7/2008	84.55	0.4	6.31%	1.06307095
8/6/2008	65.4	0.4	-22.18%	0.77823773
11/5/2008	49.55	0.4	-23.62%	0.76376147
1/2/2009	45.25		-8.68%	0.91321897
			-46.50%	0.535006

Date	Price	Dividend	R	1+R
1/3/2011	66.4			
2/9/2011	72.63	0.42	10.02%	1.1001506
5/11/2011	79.08	0.42	9.46%	1.09458901
8/10/2011	57.41	0.42	-26.87%	0.73128477
11/8/2011	66.65	0.42	16.83%	1.16826337
1/3/2012	74.22		11.36%	1.11357839
			14.56%	1.14564829



8. Given the data presented, make the calculations requested in the question.

a. Average annual return

$$= (-7\% + 23\% + 18\% + 6\%) / 4$$

$$= 10\%$$

b. Variance of returns =
$$\frac{(-7\% - 10\%)^2 + (23\% - 10\%)^2 + (18\% - 10\%)^2 + (6\% - 10\%)^2}{3}$$

$$= 179.33333$$

c. Standard deviation of returns =
$$\sqrt{\text{variance}} = \sqrt{179.3333} = 13.39\%$$

The average annual return is 10%. The variance of return is 179.33. The standard deviation of returns is 13.39%.



9. (See also SBUX_GOOG_ans.xlsx)

a. 0.2186, 0.2363 with dividends

b. 0.0751

c. $(0.30)(0.2363) + (0.70)(0.0751) = 0.1235$



10. Plan: Download the Excel spreadsheet data and analyze it.

Execute: a/b. Using Excel:

	S&P 500	Small Stocks	Corp Bonds	World Portfolio	Treasury Bills	CPI
Average	2.553%	16.550%	5.351%	2.940%	0.859%	-1.491%
Variance:	0.1018	0.6115	0.0013	0.0697	0.0002	0.0022
Standard						
Deviation:	31.904%	78.195%	3.589%	26.398%	1.310%	4.644%

Evaluate:

c. The riskiest assets were the small stocks. Intuition tells us that this asset class would be the riskiest.



11. Plan: For part (a), to compute the arithmetic average, use Eq. 11.3. For part (b), to compute the geometric average, take the product of $1 +$ each return and then take the 10th root of that product (see the box on page 341). For part (c), realize that the total return computed in part (b) before taking the average can be applied directly to the \$100.

Execute:

a. Using Eq. 11.3:

$$(-0.1993 + 0.166 + 0.18 - 0.5 + 0.433 + 0.012 - 0.165 + 0.456 + 0.452 - 0.03)/10 = 0.0805$$

*b. $(0.801)(1.166)(1.180)(0.500)(1.433)(1.012)(0.835)(1.456)(1.452)(0.970) = 1.3683$

$$(1.367)^{\frac{1}{10}} = 1.03176. \text{ Subtracting the 1, we get the geometric average of } 0.0319.$$

c. In part (b) we computed the total realized return as the product of $1 +$ each year's return. We would have earned that return on the \$100, so the answer is $\$100(1.3683) = \136.83 .

Evaluate:

The geometric average return is a better representation of what actually happened. However, the arithmetic average is a better estimate of what you can expect to happen in any given year (if you were trying to forecast the return for next year, for example).



12.

Historical Stock and Dividend Data		
Date	Price	Dividend
1/2/03	33.88	
2/5/03	30.67	0.17
5/14/03	29.49	0.17
8/13/03	32.38	0.17
11/12/03	39.07	0.17
1/2/04	41.99	

Plan: Calculate the realized return for each period and then compound those returns.

Execute: Return from 1/2/03 → 2/5/03

$$\begin{aligned} R_1 &= \frac{30.67 + 0.17}{33.88} - 1 \\ &= -0.08973 \end{aligned}$$

Return from 2/5 → 5/14

$$\begin{aligned} R_2 &= \frac{29.49 + 0.17}{30.67} - 1 \\ &= -0.03293 \end{aligned}$$

Return from 5/14 → 8/13

$$\begin{aligned} R_3 &= \frac{32.38 + 0.17}{29.49} - 1 \\ &= 0.10376 \end{aligned}$$

Return from 8/13 → 11/12

$$\begin{aligned} R_4 &= \frac{39.07 + 0.17}{32.38} - 1 \\ &= 0.21186 \end{aligned}$$

Return from 11/12 → 1/2

$$\begin{aligned} R_5 &= \frac{41.99}{39.07} - 1 \\ &= 0.07474 \end{aligned}$$

Return for the year is:

$$(1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4)(1 + R_5) - 1 = 26.55\%.$$

Evaluate:

Taking into account both dividends and price changes, the return on this stock from January 2, 2003, to January 2, 2004, was 26.55%.

- 13. Plan:** Calculate the dividend yield and capital gain for the stock over the same time period as in the previous problem.

Execute: Dividend Return from 1/2/03 → 2/5/03

$$\begin{aligned} R_1 &= \frac{0.17}{33.88} \\ &= 0.00502 \end{aligned}$$

Dividend Return from 2/5 → 5/14

$$\begin{aligned}R_2 &= \frac{0.17}{30.67} \\ &= 0.00554\end{aligned}$$

Dividend Return from 5/14 → 8/13

$$\begin{aligned}R_3 &= \frac{0.17}{29.49} \\ &= 0.00576\end{aligned}$$

Dividend Return from 8/13 → 11/12

$$\begin{aligned}R_4 &= \frac{0.17}{32.38} \\ &= 0.00525\end{aligned}$$

Dividend Return from 11/12 → 1/2

$$R_5 = \frac{0}{39.07} = 0$$

Dividend Return for the year is:

$$(1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4)(1 + R_5) - 1 = 2.1745\%.$$

Capital Gain Return from 1/2/03 → 2/5/03

$$\begin{aligned}R_1 &= \frac{30.67}{33.88} - 1 \\ &= -0.09475\end{aligned}$$

Capital Gain Return from 2/5 → 5/14

$$\begin{aligned}R_2 &= \frac{29.49}{30.67} - 1 \\ &= -0.03847\end{aligned}$$

Capital Gain Return from 5/14 → 8/13

$$\begin{aligned}R_3 &= \frac{32.38}{29.49} - 1 \\ &= 0.09800\end{aligned}$$

Capital Gain Return from 8/13 → 11/12

$$\begin{aligned}R_4 &= \frac{39.07}{32.38} - 1 \\ &= 0.20661\end{aligned}$$

Capital Gain Return from 11/12 \rightarrow 1/2

$$R_5 = \frac{41.99}{39.07} - 1$$

$$= 0.07474$$

Capital Gain Return for the year is:

$$(1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4)(1 + R_5) - 1 = 23.938\%$$

Evaluate: The total return for the year should be equal to the compound of the capital gain and dividend returns for the year.

$$(1 + \text{capital gain})(1 + \text{dividend}) - 1 = (1 + 0.23938)(1 + 0.021745) - 1$$

$$= 26.63\%$$

The difference is due to rounding.

The dividend yield on the stock from January 2, 2003, to January 2, 2004, was 2.1754%. The capital gain return on the stock from January 2, 2003, to January 2, 2004, was 23.938%.

- 14. Plan:** Compute the arithmetic average return using Eq. 11.3. For part (b), to compute the geometric average, take the product of $1 +$ each return and then take the 10th root of that product (see the box on page 341). For parts (c) and (d), use Eq. 11.4 and Eq. 11.5 to calculate the variance and standard deviation of returns.

a. $(0.05 - 0.02 + 0.04 + 0.08 - 0.01)/5 = 0.028$

*b. $(1.05)(0.98)(1.04)(1.08)(0.99) = 1.1442$

$$(1.1442)^{\frac{1}{5}} - 1 = 0.0273$$

$$\begin{aligned} & (0.05 - 0.028)^2 + (-0.02 - 0.028)^2 + (0.04 - 0.028)^2 + \\ & (0.08 - 0.028)^2 + (-0.01 - 0.028)^2 \\ \text{c. } Var(R) = & \frac{\quad}{5 - 1} \\ & = 0.00177 \end{aligned}$$

d. Standard Dev (R) = $\sqrt{Var(R)} = \sqrt{0.00177} = 0.042$

Evaluate:

The arithmetic and geometric averages are different (see the box on page 341), but not by much. The standard deviation reveals that the returns are volatile around the average.

- 15.** The answers are different because the arithmetic average return basically assumes that you reset your investment every year. It is the best measure to use to predict the most likely annual return next year. However, it is not the best representation of how your investment actually performed. The geometric average return does that.

16. Plan: Given the data presented, make the calculations requested in the question.

Execute:

- a. Average annual return = $\frac{-4\% + 28\% + 12\% + 4\%}{4} = 10\%$
- b. Variance of returns = $\frac{(-4\% - 10\%)^2 + (28\% - 10\%)^2 + (12\% - 10\%)^2 + (4\% - 10\%)^2}{3}$
 $= 0.01867$
- c. Standard deviation of returns = $\sqrt{\text{variance}} = \sqrt{0.01867} = 13.66\%$

Evaluate: The average annual return is 10%. The variance of return is 0.01867. The standard deviation of returns is 13.66%.

17. Plan: Given the data in Figures 11.3 and 11.4, calculate the 95% confidence intervals for the four securities mentioned. Use Eq. 11.6.

Execute:

Small Stocks: $0.2205 \pm 2 \times 0.4262 = [-0.6319, 1.0729]$

S&P 500: $0.1174 \pm 2 \times 0.2052 = [-0.2930, 0.5278]$

Corp Bonds: $0.0649 \pm 2 \times 0.0704 = [-0.0759, 0.2057]$

Treasury Bills: $0.0409 \pm 2 \times 0.0342 = [-0.0275, 0.1093]$

Evaluate: The 95% confidence interval is two standard deviations from the right and the left of the mean. For example, for small stocks it ranges from -0.6319 to 1.0729.

18. For this, choose the investments that have the lower limit of the 95% Confidence Interval that is above -8%. These investments are Corporate Bonds and Treasury Bills.

19. Plan: The range would be a 95% prediction interval that runs from two standard deviations below the average return to two standard deviations above the average return.

Execute: $0.1174 - 2(0.2052)$ to $0.1174 + 2(0.2052) = -0.2930$ to $+0.5278$

Evaluate:

In order to be 95% confident about your prediction, you have to have a very wide range. This is because of the substantial volatility in the returns.

20. Plan: Using a 95% prediction interval, the bottom of the prediction range is two standard deviations below the average return. Then, compare the bottom of the prediction interval to the minimum return (-40%) that you are willing to tolerate:

Execute:

$$0.15 - 2(0.25) = 0.15 - 0.50 = -0.35$$

Yes, the low end of the 95% prediction interval is -35%, which is smaller than -40%.

Evaluate: Even though the average return is 15%, the returns themselves are volatile enough that you can only just barely be 95% confident that you will not suffer a 40% loss.

- *21. Plan:** Calculate the expected payoff of each bank's loans. Recognize that Bank A has a portfolio of independent loans, so we would expect diversification to reduce the volatility of its loan portfolio.

Execute:

- a. Expected payoff is the same for both banks:

$$\text{Bank A} = (\$1 \text{ million} \times 0.95) \times 100 = \$95 \text{ million}$$

$$\text{Bank B} = \$100 \text{ million} \times 0.95 = \$95 \text{ million}$$

- b. Bank A:

$$\text{Variance of each loan} = (1 - 0.95)^2 0.95 (0 - 0.95)^2 0.05 = 0.0475$$

$$\text{Standard Deviation of each loan} = \sqrt{0.0475} = 0.2179$$

Bank B:

$$\text{One loan: Variance} = (100 - 95)^2 0.95 + (0 - 95)^2 0.05 = 475$$

$$\text{Standard Deviation} = \sqrt{475} = 21.79$$

Now Bank A has 100 loans that are all independent of each other so the standard deviation of the average loan is:

$$\frac{0.2179}{\sqrt{100}} = 0.02179$$

But the bank has 100 such loans so the standard deviation of the portfolio is

$$100 \times 0.02179 = 2.179,$$

which is much lower than Bank B.

Evaluate:

Even though the two banks have the same expected return on their loans, Bank A's position is much safer because it has diversified its \$100 million across 100 independent loans.

- 22.** a. A risk-taking investor would choose the economy in which stock returns are moving in the same direction because this risk cannot be diversified away, even by investing in a large portfolio.
- b. A risk-neutral investor would be indifferent in choosing investment in either one of two economies.
- c. A risk-averse investor would choose the economy in which stock returns are independent because this risk can be diversified away in a large portfolio.

Chapter 12

Systematic Risk and the Equity Risk Premium

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Calculate each investment's weight as the amount invested in it as a proportion of the total amount invested.

Execute:

Tide pool: $200 \times \$55 = \$11,000$

Mad fish: $400 \times \$25 = \$10,000$

Weight on Tide pool = $\$11,000 / (\$11,000 + \$10,000) = 52.38\%$

Weight on Mad fish = $\$10,000 / (\$11,000 + \$10,000) = 47.62\%$

Evaluate: You cannot tell the weights just by the number of shares; what matters is the total dollar amounts invested in each stock.

2. **Plan:** The expected return on any portfolio is the weighted average of the expected returns of the securities in the portfolio. Therefore we will compute the weighted average return on this portfolio.

Execute: $E[R_p] = (60\%)(25\%) + (40\%)(12\%) = 19.8\%$

Evaluate: The expected return on this portfolio is 19.8%.

3. **Plan:** Perform the calculations to answer the questions in the problem.

Execute:

- a. Let n_i be the number of shares in stock i , then

$$n_G = \frac{200,000 \times 0.5}{25} = 4,000$$

$$n_M = \frac{200,000 \times 0.25}{80} = 625$$

$$n_V = \frac{200,000 \times 0.25}{2} = 25,000$$

The new value of the portfolio is

$$\begin{aligned} p &= 30n_G + 60n_M + 3n_V \\ &= \$232,500 \end{aligned}$$

$$\begin{aligned} \text{b. Return} &= \frac{232,500}{200,000} - 1 \\ &= 16.25\% \end{aligned}$$

c. The portfolio weights are the fraction of value invested in each stock

$$\text{GoldFinger: } \frac{n_G \times 30}{232,500} = 51.61\%$$

$$\text{Moosehead: } \frac{n_M \times 60}{232,500} = 16.13\%$$

$$\text{Venture: } \frac{n_V \times 3}{232,500} = 32.26\%$$

Evaluate:

- a. The new value of the portfolio is \$232,500.
 - b. The return on the portfolio was 16.25%.
 - c. If you do not buy or sell shares after the price change, your new portfolio weights are GoldFinger 51.61%, Moosehead 16.13%, and Venture 32.26%.
4. **Plan:** Compute the weights on each investment and then, matching those weights to the expected returns, compute the expected return of the portfolio using Eq. 12.3.

Execute:

$\$38,000/\$85,000 = 0.447$, which is the weight on the second stock. Since the weights must sum to 1, the weight on the final stock is $(1 - 0.447 - 0.25)$.

$$E[R] = (0.25)(0.18) + (0.447)(0.25) + (1 - 0.447 - 0.25)(0.22) = 0.2234$$

Evaluate:

The expected return of the portfolio is a weighted average of the expected returns of the stocks. The biggest weight on any individual stock in this case is the 44.7% on the stock with a 25% return.

5. Both calculations of expected return of a portfolio give the same answer.
6. If the price of one stock goes up, the other stock price always goes up as well. Similarly, if one goes down, the other will also be going down.



- 7. Plan:** Use Eqs 12.3–12.5 to answer parts (a) and (b). Use Eqs. 12.3 and 12.4 to answer part (c).

Execute:

a.

$$E[R_A] = \frac{0.1 + 0.07 + 0.15 - 0.05 + 0.08}{5} = 0.07$$

$$E[R_B] = \frac{0.06 + 0.02 + 0.05 + 0.01 - 0.02}{5} = 0.024$$

b.

$$\begin{aligned} & (0.1 - 0.07)^2 + (0.07 - 0.07)^2 + (0.15 - 0.07)^2 + \\ & \text{Var}(R_A) = \frac{(-0.05 - 0.07)^2 + (0.08 - 0.07)^2}{5 - 1} = 0.00545 \end{aligned}$$

$$\text{StdDev}(R_A) = \sqrt{0.00545} = 0.0738$$

$$\begin{aligned} & (0.06 - 0.024)^2 + (0.02 - 0.024)^2 + (0.05 - 0.024)^2 + \\ & \text{Var}(R_B) = \frac{(0.01 - 0.024)^2 + (-0.02 - 0.024)^2}{5 - 1} = 0.00103 \end{aligned}$$

$$\text{StdDev}(R_B) = \sqrt{0.00103} = 0.0321$$

c.

$$E[R_p] = 0.7(0.07) + 0.3(0.024) = 0.0562$$

$$\text{Var}(R_p) = 0.7^2(0.0738)^2 + 0.3^2(0.0321)^2 + 2(0.7)(0.3)(0.0738)(0.0321)(0.46) = 0.00352$$

$$\text{StdDev}(R_p) = \sqrt{0.00352} = 0.0593$$

Evaluate:

Even with most of the portfolio's weight on the riskier stock, the diversification effect brings the overall portfolio risk down below a weighted average of the two standard deviations.



- 8. Plan:** Calculate the expected return and volatility of Stock A and Stock B.

Realized Returns		
Year	Stock A	Stock B
2005	−10%	21%
2006	20%	30%
2007	5%	7%
2008	−5%	−3%
2009	2%	−8%
2010	9%	25%

Execute:

$$\bar{R}_A = \frac{-10 + 20 + 5 - 5 + 2 + 9}{6}$$

$$= 3.5\%$$

$$\bar{R}_B = \frac{21 + 30 + 7 - 3 - 8 + 25}{6}$$

$$= 12\%$$

$$\begin{aligned} \text{Variance of } A &= \frac{1}{5} \left[\begin{aligned} &(-0.1 - 0.035)^2 + (0.2 - 0.08)^2 + \\ &(0.05 - 0.035)^2 + (-0.05 - 0.035)^2 + \\ &(0.02 - 0.035)^2 + (0.09 - 0.035)^2 \end{aligned} \right] \\ &= 0.01123 \end{aligned}$$

$$\text{Volatility of } A = SD(R_A) = \sqrt{\text{Variance of } A} = \sqrt{0.01123} = 10.60\%$$

$$\begin{aligned} \text{Variance of } B &= \frac{1}{5} \left[\begin{aligned} &(0.21 - 0.12)^2 + (0.3 - 0.12)^2 + \\ &(0.07 - 0.12)^2 + (-0.03 - 0.12)^2 + \\ &(-0.08 - 0.12)^2 + (0.25 - 0.12)^2 \end{aligned} \right] \\ &= 0.02448 \end{aligned}$$

$$\text{Volatility of } B = SD(R_B) = \sqrt{\text{Variance of } B} = \sqrt{0.02448} = 15.65\%$$


Evaluate: The return on Stock A is 3.5% with a volatility of 10.60%. The return on Stock B is 12% with a volatility of 15.65%.

9. **Plan:** Calculate the volatility of a portfolio that is 70% invested in Stock A and 30% invested in Stock B.

Execute:

$$\begin{aligned} \sigma &= \sqrt{(0.7)^2(0.1060)^2 + (0.3)^2(0.1565)^2 + 2(0.7)(0.3)(0.1060)(0.1565)(0.48)} \\ &= 0.1051 \\ &= 10.51\% \end{aligned}$$

Evaluate: The volatility of a portfolio of 70% invested in Stock A and 30% in Stock B is 10.51%.


-  **10. Plan:** Calculate the average monthly return and volatility for the stock of Cola Co. and Gas Co.

Date	Cola Co.	Gas Co.
Jan	-10.84%	-6.00%
Feb	2.36%	1.28%
Mar	6.60%	-1.86%
Apr	2.01%	-1.90%
May	18.36%	7.40%
June	-1.22%	-0.26%
July	2.25%	8.36%
Aug	-6.89%	-2.46%
Sep	-6.04%	-2.00%
Oct	13.61%	0.00%
Nov	3.51%	4.68%
Dec	0.54%	2.22%

Execute: The mean for Cola Co. is 2.02%; the mean for Gas Co. is 0.79%.

The standard deviation (i.e., volatility) for Cola Co. is 8.24%; the standard deviation for Gas Co. is 4.25%.

Evaluate: Cola Co. has a higher mean return (2.02%) than Gas Co. (0.79%). But Cola Co. has more volatility (8.24%) than Gas Co. (4.25%). This is consistent with Finance Theory—higher risk is associated with higher average return.

-  **11.** All three methods have the same result: The standard deviation (i.e., volatility) is 5.90%.

12.

Year	North Air	West Air	Tex Oil	N+W	W+T	Portfolio
2007	21%	9%	-2%	15.0%	3.5%	6.50%
2008	30%	21%	-5%	25.5%	8.0%	10.25%
2009	7%	7%	9%	7.0%	8.0%	8.00%
2010	-5%	-2%	21%	-3.5%	9.5%	8.75%
2011	-2%	-5%	30%	-3.5%	12.5%	13.25%
2012	9%	30%	7%	19.5%	18.5%	13.25%

13. Microsoft's $\sigma = 0.28$; Ford's $\sigma = 0.59$; The correlation between Microsoft and Ford is 0.36, and the weights are 50% each:

$$\begin{aligned}\sigma_p^2 &= w_F^2 \sigma_F^2 + w_{MSFT}^2 \sigma_{MSFT}^2 + 2w_F w_{MSFT} \sigma_F \sigma_{MSFT} \rho_{F,MSFT} \\ \sigma_p^2 &= 0.5^2 (0.59)^2 + 0.5^2 (0.28)^2 + 2(0.5)(0.5)(0.59)(0.28)(0.36) \\ \sigma_p^2 &= 0.13636 \\ \sigma_p &= 0.369\end{aligned}$$

14. **Plan:** Use Eqs. 12.3 and 12.4 to compute the expected return and volatility of the indicated portfolio.

Execute: In this case, the portfolio weights are $x_j = x_w = 0.50$. From Eq. (12.3),

$$\begin{aligned}E[R_p] &= x_j E[R_j] + x_w E[R_w] \\ &= 0.50(7\%) + 0.50(10\%) \\ &= 8.5\%\end{aligned}$$

We can take the square root of the portfolio variance equation (Eq. 12.4), to get the standard deviation.

$$\begin{aligned}SD(R_p) &= \sqrt{x_j^2 SD(R_j)^2 + x_w^2 SD(R_w)^2 + 2x_j x_w \text{Corr}(R_j, R_w) SD(R_j) SD(R_w)} \\ &= \sqrt{0.50^2 (0.16)^2 + 0.50^2 (0.20)^2 + 2(0.50)(0.50)(0.22)(0.16)(0.20)} \\ &= 14.1\%\end{aligned}$$

Evaluate: The portfolio would have an expected return of 8.5% and a standard deviation of return of 14.1%. The relatively low correlation coefficient helps reduce the risk of the portfolio.

15.

stock vol	40%
corr	50-50 Port
1	40.0%
0.5	34.6%
0	28.3%
-0.5	20.0%
-1	0.0%

Volatility of portfolio is less if the correlation is < 1 .

16.

	Vol	Corr
Wesley	60%	25%
Addison	30%	
Portfolio		
x_A	x_W	Vol
100%	0%	30.00%
75%	25%	30.00%
50%	50%	36.74%

17. **Plan:** You must estimate the expected return and volatility of each portfolio created by adding Stock A or Stock B. You will select that portfolio that gives you the greatest return or the least volatility.

Execute: The expected return of the portfolio will be the same (17.4%) if you pick A or B because both A and B have the same expected return. Therefore, the choice of A or B depends on how risky the portfolio becomes when you add A or B.

For A:

$$\begin{aligned}\sigma &= \sqrt{(0.8)^2(0.30)^2 + (0.2)^2(0.25)^2 + 2(0.8)(0.2)(0.30)(0.25)(0.2)} \\ &= 0.2548 \\ &= 25.48\%\end{aligned}$$

For B:

$$\begin{aligned}\sigma &= \sqrt{(0.8)^2(0.30)^2 + (0.2)^2(0.20)^2 + 2(0.8)(0.2)(0.30)(0.20)(0.6)} \\ &= 0.2659 \\ &= 26.59\%\end{aligned}$$

Evaluate: Because the portfolio is less risky when A is added, you should add A to the portfolio.

18. **Plan:** Stocks B and C are identical except for the fact that Stock B has a lower correlation with A than C does. Given that B and C's standard deviations are the same, the one with the lower correlation with A will produce a lower portfolio standard deviation. Because she will be putting \$100,000 in each stock, her portfolio will be 50% in each stock.

Execute:

Using B:

$$\begin{aligned}E[R_p] &= 0.5(0.15) + 0.5(0.13) = 0.14 \\ \text{Var}(R_p) &= 0.5^2 0.5^2 + 0.5^2 0.4^2 + 2(0.5)(0.5)(0.5)(0.4)(0.2) = 0.1225 \\ \text{StdDev}(R_p) &= \sqrt{0.1225} = 0.35\end{aligned}$$

You can confirm that this is lower than the standard deviation of a portfolio with A and C:


$$E[R_p] = 0.5(0.15) + 0.5(0.13) = 0.14$$

$$\text{Var}(R_p) = 0.5^2 0.5^2 + 0.5^2 0.4^2 + 2(0.5)(0.5)(0.5)(0.4)(0.3) = 0.1325$$

$$\text{StdDev}(R_p) = \sqrt{0.1325} = 0.364$$

Evaluate:

By choosing the stock that has the lower correlation with A, you can achieve the goal of an expected return of 14% with a lower standard deviation than if you had chosen the stock with the higher correlation.

-  **19. Plan:** Compute the total market value of the total portfolio and the weighted percent that each individual stock would be in the market portfolio.

Execute: Total value of the

market = $10 \times 10 + 20 \times 12 + 8 \times 3 + 50 \times 1 + 45 \times 20 = \1.314 billion.

Stock	Portfolio Weight
A	$\frac{10 \times 10}{1,314} = 7.61\%$
B	$\frac{20 \times 12}{1,314} = 18.26\%$
C	$\frac{8 \times 3}{1,314} = 1.83\%$
D	$\frac{50}{1,314} = 3.81\%$
E	$\frac{45 \times 20}{1,314} = 68.49\%$

Evaluate: The market portfolio would have a value of \$1.314 billion. Stock A would be 7.61% of the market portfolio, Stock B would be 18.26%, Stock C would be 1.83%, Stock D would be 3.81%, and Stock E would be 68.49%.



- 20. Plan:** Compute the total market value of the total portfolio and the weighted percent that each individual stock would be in the market portfolio.

Execute: Total value of all four stocks

$$= 13 \times 1.00 + 22 \times 1.25 + 43 \times 30 + 5 \times 10 = \$1,380.5 \text{ billion.}$$

Stock	Portfolio Weight
Golden Seas	$\frac{13 \times 1.00}{1,380.5} = 0.942\%$
Jacobs and Jacobs	$\frac{22 \times 1.25}{1,380.5} = 1.992\%$
MAG	$\frac{43 \times 30}{1,380.5} = 93.444\%$
PDJB	$\frac{5 \times 10}{1,380.5} = 3.622\%$

Evaluate: The market portfolio would have a value of \$1,380.5 billion. Golden Seas would be 0.942% of the market portfolio, Jacobs and Jacobs would be 1.992%, MAG would be 93.444%, and PDJB would be 3.622%.

- 21.** Nothing needs to be done. The portfolio is still value-weighted.

- 22. Plan:** Compute the excess returns of Apple and Proctor & Gamble.

Execute:

- The best guess to Apple's return today is the product of the market return and Apple's beta.
Apple's return = $-2\% \times 1.4 = -2.8\%$.
- P&G's return = $-2\% \times 0.5 = -1\%$.

Evaluate: Apple's excess return is -2.8% , and P&G's is -1.0% .



- 23. Plan:** Go to the MyFinanceLab Web site and access the Excel spreadsheet. Use the slope function to estimate the slope coefficient of the data, which is our estimate of beta.

Execute: Using Excel's slope function, the beta of Nike's stock is 0.64.

Evaluate: The estimate of beta for Nike is 0.64.



- 24. Plan:** Go to the MyFinanceLab Web site and access the Excel spreadsheet. Use the slope function to estimate the slope coefficient of the data, which is our estimate of beta.

Execute:

- a. Solving for Microsoft's beta using the slope function in Excel:
 1987–1991: 1.4110
 1992–1996: 0.8544
 1997–2001: 1.8229
 2002–2006: 1.0402

Evaluate:

- b. It decreased in the early 1990s as Microsoft established itself as the dominant operating software company but increased during the Internet bubble in the late 1990s (when tech stocks were soaring). It has since decreased.

- 25. Plan:** Compute the expected return for Johnson & Johnson.

Execute: Expected Return = $5\% + 0.98 (0.15 - 0.05) = 14.8\%$

Evaluate: The expected return for Johnson & Johnson is 14.8%.

- 26.** The sign of the risk premium for a negative beta stock is negative. This is because the negative beta stock acts as “recession insurance,” and thus investors are willing to pay for this insurance in the form of a lower return than the risk-free rate.
- 27. Plan:** The beta of a portfolio is a weighted average of the betas of the stocks in the portfolios. The weights are the weights of the stocks in the portfolios.

Execute: $\beta_p = (0.35)(1.8) + (0.25)(0.8) + (0.4)(1.2) = 1.31$

Evaluate: Because betas only represent nondiversifiable risk, there is no “diversification effect” on beta from a portfolio. So, the beta of a portfolio is simply the weighted average of the betas of the securities in the portfolio.

28.

$$\beta = (0.6)(2.16) + (0.4)(0.69) = 1.572$$

$$E[R] = 4 + (1.572)(10 - 4) = 13.432\%$$

- 29. Plan:** Compute the expected returns of Intel and Boeing as well as the portfolio beta. Then compute the expected return of the portfolio.

Execute:

- a. Intel's Expected Return = $5\% + 1.8 (0.15 - 0.05) = 23\%$
- b. Boeing's Expected Return = $5\% + 1.2 (0.15 - 0.05) = 17\%$
- c. Portfolio Beta = $(70\%)(1.8) + (30\%)(1.2) = 1.62$
- d. Portfolio's Expected Return = $5\% + 1.62 (0.15 - 0.05) = 21.2\%$

or Portfolio's Expected Return = $(70\%)(23\%) + (30\%)(17\%) = 21.2\%$

Evaluate Intel's expected return is 23%, Boeing's expected return is 17%, the portfolio beta is 1.62, and the expected return of the portfolio is 21.2%.

***30. Plan:** Compute the necessary beta.

Execute: Return on the stock = $(1.5 + 122 - 103) / 103 = 19.9\%$

For 19.9% to be the expected return on the stock, solve for beta:

$$\text{Expected Return} = 19.9\% = 5.5\% + \text{beta} \times 9\%$$

$$\begin{aligned}\text{beta} &= (19.9\% - 5.5\%) / 9\% \\ &= 1.6\end{aligned}$$

Evaluate: A beta of 1.6 would be consistent with an 19.9% return on the stock..

***31. Plan:** Compute what the expected return for a stock with a beta of 2.4 should be. You should buy the stock if the expected return is 15% or less.

Execute: Expected Return = $3\% + 2.4 \times 8\% = 22.2\%$

Evaluate: No, you should not buy the stock. You should expect a return of 22.2% for taking on an investment with a beta of 2.4. But since this stock only returns 15%, it does not fully compensate you for the risk of the stock, and you can find other investments that will return 15% with less risk.

32. Plan: Compute the expected return for the coffee company.

Execute: Expected Return = $6\% + 0.8 \times 13\% = 16.4\%$

Evaluate: The coffee company should produce a return of 16.4% to compensate its equity investors for the riskiness of their investment.

33. Plan: Compute the expected return and the realized return for Apple.

Execute:

$$\text{Expected Return} = 3\% + 1.2 \times 6\% = 10.2\%$$

$$\text{Realized Return} = (80 - 75) / 75 = 6.67\%$$

Evaluate: Thus, Apple's managers greatly exceeded the required return of investors, as given by the CAPM.

- *34. Plan:** First, solve for the market risk premium. You know the expected return for Bay Corp., the risk-free rate and its beta, so you can algebraically solve for the market risk premium. Using that risk premium and the desired beta, you can check that the desired expected return is consistent with the CAPM. Finally, you need to solve for the weights on the two companies' betas that would produce a portfolio beta of 1.4.

Execute:

$$0.112 = 0.04 + 1.2(E[R_M] - r_f)$$

$$E[R_M] - r_f = \frac{0.112 - 0.04}{1.2} = 0.06$$

Using the fact that the risk premium is 0.06 and the desired portfolio beta of 1.4, its $E\{R\} = 0.04 + 1.4(0.06) = 0.124$, so the portfolio beta and desired expected return are consistent with each other.

To form a portfolio with a beta of 1.4, using Bay Corp. and City Corp., you need to solve for the weights:

$$1.4 = x(1.2) + (1 - x)(1.8)$$

$$-0.4 = -0.6x$$

$$x = (-0.4/-0.6) = 2/3$$

Put 2/3 of your money in Bay Corp. and 1/3 in City Corp.

Evaluate:

You can achieve your goals by creating a portfolio with a beta of 1.4. Doing so requires putting two-thirds of your money into Bay and one-third into City.

Chapter 13

The Cost of Capital

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Compute the weights for the WACC.

Execute:

Value of debt: \$100 million

Value of preferred stock: \$20 million

Market value of common equity: \$50 per share \times 6 million shares = \$300 million

Total market value of firm: \$100 + 20 + 300 = \$420 million

Weights for WACC calculation:

$$\text{Debt } \frac{100}{420} = 23.81\%$$

$$\text{Preferred Stock } \frac{20}{420} = 4.76\%$$

$$\text{Common Equity } \frac{300}{420} = 71.43\%$$

Evaluate: The total market value of the firm is \$420 million. Debt is 23.81% of the total value, preferred stock is 4.76%, and common equity is 71.43%.

2. **Plan:** Compute the market value weights to compute the WACC.

Execute:

Book value of equity = \$600

Market value of equity = \$600 \times 1.5 = \$900

Book value of debt = \$400

Total market value of firm = \$1300

Weights for WACC calculation:

$$\text{Debt } \frac{400}{1300} = 30.77\%$$

$$\text{Common Equity } \frac{900}{1300} = 69.23\%$$

Evaluate: Debt is 30.77% of the capital structure and equity is 69.23%.

- 3. Plan:** The book value of its equity and debt are not relevant for computing the weights for its WACC. Those weights should be based on market values. We need to calculate the market value of its debt and of its equity. The MV of its equity equals the number of shares outstanding times its current price per share. The MV of its debt can be calculated by multiplying its price relative to par by the par value.

Execute:

- a. MV equity: 2 million shares \times \$25 per share = \$50 million
- b. MV debt: 105% of par \times \$40 million par = \$42 million
- c. Equity weight: \$50 million / (\$50 million + \$42 million) = 54.35%
- Debt weight: \$42 million / (\$50 million + \$42 million) = 45.65%

Evaluate: The book values would give you the wrong weights. The WACC should be based on the relative market values of the company's capital sources, not the historical book values.

- 4. Plan:** Compute the firm's pre tax WACC and the value of a portfolio containing 40% of the firm's debt and 60% of the firm's equity. Show that the expected returns are identical.

Execute: If the firm's assets are to be worth either \$1,200 or \$960 in one year (with equal probability), what does this mean for the value of the debt and equity of the firm? At a 5% interest rate, the debt will be worth \$420 in one year. Because the debt has seniority over equity on its claim of the firm's assets, the assets will be large enough in one year to fulfill the debt obligations, so the debt will be worth \$420 in either case. Thus, the equity will be worth either \$780 or \$540 in one year.

Expected return on assets:

50% chance of \$1,200 in one year:

$$\begin{aligned}\text{Return} &= \frac{1,200 - 1,000}{1,000} \\ &= 20\%\end{aligned}$$

50% chance of \$960 in one year:

$$\begin{aligned}\text{Return} &= \frac{960 - 1,000}{1,000} \\ &= -4\%\end{aligned}$$

Expected return on assets = (50%)(20%) + (50%)(-4%) = 8%.

Portfolio of 40% debt and 60% equity:

Expected return on debt:

$$\frac{420 - 400}{400} = 5\%$$

Expected return on equity:

50% chance of \$780 in one year:

$$\begin{aligned}\text{Return} &= \frac{780 - 600}{600} \\ &= 30\%\end{aligned}$$

50% chance of \$540 in one year:

$$\begin{aligned}\text{Return} &= \frac{540 - 600}{600} \\ &= -10\%\end{aligned}$$

Expected return on equity = $(50\%)(30\%) + (50\%)(-10\%) = 10\%$.

Expected return on portfolio of 40% debt and 60% equity = $(40\%)(5\%) + (60\%)(10\%) = 8\%$.

Evaluate: The expected return on the portfolio of 40% debt and 60% equity is identical to the expected return on the assets of the firm.

5. **Plan:** Compute Avocorp's pretax cost of debt and its after-tax cost of debt.

Execute:

The pre-tax cost of debt is the YTM on the outstanding debt issue. We solve for the six-month YTM on the bond, and then compute the EAR.

$$\begin{aligned}\$98 &= \frac{4}{(1 + \text{YTM}_{6 \text{ month}})} + \frac{4}{(1 + \text{YTM}_{6 \text{ month}})^2} + \dots + \frac{4}{(1 + \text{YTM}_{6 \text{ month}})^{16}} \\ \Rightarrow \text{YTM}_{6 \text{ month}} &= 4.175\% \\ \text{EAR} &= (1 + 4.175\%)^2 - 1 \\ &= 8.5243\%\end{aligned}$$

The pre-tax cost of debt is 4.175% every 6 months, or 8.5243% per year.

After-tax cost of debt = $8.5243\% \times (1 - 35\%) = 5.54\%$

Evaluate: Avocorp's before-tax cost of debt is 8.5243% per year, while its after-tax cost of debt (reflecting the tax deductibility of interest) is 5.54%.

6. **Plan:** Compute Laurel's after-tax cost of debt.

Execute: The pre-tax cost of debt is the yield to maturity on the existing debt, or 8%. Thus, the effective after-tax cost of debt is $\text{after-tax cost of debt} = 8\% \times (1 - 40\%) = 4.8\%$

Evaluate: Laurel's before-tax cost of debt is 8%; its after-tax cost of debt is 4.8%.

- 7. Plan:** Compute the cost of preferred stock for Dewyco.

Execute: The price of the preferred stock is \$80, and this price should be the present value of the perpetuity of preferred stock dividends. Therefore, the cost of capital for preferred stock is:

$$\begin{aligned} \$80 &= \$5/r_{ps} \\ r_{ps} &= \$5/\$80 \\ &= 6.25\% \end{aligned}$$

Evaluate: Dewyco's cost of preferred stock is 6.25%.

- 8. Plan:** Compute Steady Company's cost of equity.

Execute: Using the Capital Asset Pricing Model, Steady's cost of equity capital is: $5\% + 1.8 \times 9\% = 21.2\%$.

Evaluate: Steady Company's cost of equity is 21.2%.

- 9. Plan:** Compute Wild Swing's cost of equity.

Execute: Using the Capital Asset Pricing Model, Wild Swing's cost of equity capital is: $5\% + 3.2 \times 9\% = 33.8\%$.

Evaluate: Wild Swing's cost of equity is 33.8%.

- 10. Plan:** Compute HighGrowth's cost of equity capital.

Execute: The price of the stock is \$50, and this price should be the present value of the growing perpetuity of stock dividends. Therefore, the cost of equity capital for HighGrowth Company is:

$$\begin{aligned} \$50 &= \$2.5 / (r_e - 0.03) \\ r_e &= 8\% \end{aligned}$$

Evaluate: HighGrowth's cost of equity capital is 8%.

- 11. Plan:** Compute Slow'n Steady's cost of equity capital.

Execute: The price of the stock is \$80, and this price should be the present value of the growing perpetuity of stock dividends. Therefore, the cost of equity capital for Slow'n Steady is:

$$\begin{aligned} \$80 &= \$5 / (r_e - 0.04) \\ r_e &= 10.25\% \end{aligned}$$

Evaluate: Slow'n and Steady's cost of equity capital is 10.25%.

- 12. Plan:** Compute the cost of equity capital for Mackenzie and the dividend growth rate that would yield the same cost of equity capital.

Execute:

- a. Using the Capital Asset Pricing Model,

$$r_e = 5.5\% + 1.2 \times 5\% = 11.5\%$$

$$b. \quad 36 = \frac{2}{0.115 - g}$$

$$0.115 - g = 0.0556$$

$$g = 5.944\%$$

Evaluate: Mackenzie's cost of equity using the CAPM is 11.5%, which would require a dividend growth rate of 5.944% to result in the same cost of equity using CGDM.

- 13.
- Plan:**
- Calculate the WACC of CoffeeCarts.

$$\textbf{Execute: } WACC = (40\%)(7\%) + (60\%)(18\%) = 13.6\%$$

Evaluate: CoffeeCarts WACC is 13.6%.

14. Its after-tax costs of debt is
- $(1 - 0.35)(0.06)$

Its cost of preferred equity is $2.50/30 = 0.0833$

Its cost of common equity is $0.02 + 1.1(0.07) = 0.097$

Applying the WACC formula we have: $WACC = (0.50)(0.097) + (0.10)(0.0833) + (0.40)(1 - 0.35)(0.06) = 0.07243$

- 15.
- Plan:**
- Calculate the WACC of Pfd Company.

$$\textbf{Execute: } WACC = \frac{12}{35}(8\%)(1 - 35\%) + \frac{5}{35}(18\%) + \frac{18}{35}(12\%) = 10.53\%$$

Evaluate: Pfd's WACC is 10.53%.

- 16.
- Plan:**
- Make the numerous calculations required in the problem.

Execute:

$$a. \quad \$20 = \frac{1}{r_e - 0.04}$$

$$r_e = 9\%$$

$$b. \quad \$28 = \frac{2}{r_{ps}}$$

$$r_{ps} = 7.143\%$$

- c. The pretax cost of debt is the firm's YTM on current debt. Because the firm recently issued debt at par, then the coupon rate of that debt must be equal to the YTM of the debt. Thus, the pretax cost of debt is 6.5%.

d. Market value of debt = \$20 million

Market value of preferred stock = \$28 per share \times 1 million preferred shares = \$28 million

Market value of equity = \$20 per share \times 5 million shares outstanding = \$100 million

Market value of assets = \$20 + 28 + 100 = \$148 million

$$e. \text{ WACC} = \left(\frac{20}{148}\right)(6.5\%)(1 - 35\%) + \left(\frac{28}{148}\right)(7.143\%) + \left(\frac{100}{148}\right)(9\%) = 8.003\%$$

Evaluate: The calculation leads to a WACC of 8.003%.

- 17. Plan:** Because the retail coffee company is engaging in a scale expansion (doing more of what it already does), its WACC is the appropriate discount rate for the free cash flows from the project. The expansion can be valued using the growing perpetuity formula.

Execute:

$$PV = \frac{\$15}{0.10 - 0.03} = \$214.286$$

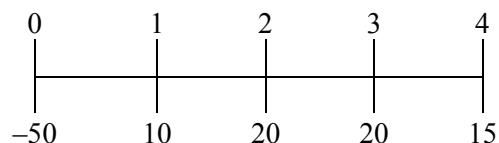
Evaluate:

Based on the projected incremental free cash flows, the expansion should proceed because it adds \$214.286 million in value to the company.

- 18. Plan:** Draw a timeline for the RiverRock project and compute its NPV.

Execute:

Timeline:



Using the WACC as the discount rate and solving for NPV:

$$\begin{aligned} \text{NPV} &= -50 + \frac{10}{1.12} + \frac{20}{(1.12)^2} + \frac{20}{(1.12)^3} + \frac{15}{(1.12)^4} \\ &= -1.359 \end{aligned}$$

Evaluate: NPV is negative; RiverRocks should not take on this project.

- 19.** If RiverRocks is going to acquire Raft Adventures, then it should use a discount rate that is appropriate for the risk of Raft Adventures' cash flows. That should be the WACC of Raft Adventures, which is 15%. So, RiverRocks should use 15% as the discount rate for its evaluation of the acquisition.
- 20. Plan:** Compute the NPV of this acquisition.

Execute: The NPV of this acquisition is:

$$-100 + \frac{15}{0.15 - 0.04} = \$36.36 \text{ million}$$

Evaluate: The acquisition has a positive NPV of \$36.36 million indicating that it will increase the value of RiverRocks.

21. Your firm is planning to invest in an automated packaging plant. Harburtin Industries is an all-equity firm that specializes in this business. Suppose Harburtin's equity beta is 0.85, the risk-free rate is 4%, and the market risk premium is 5%. If your firm's project is all equity financed, estimate its cost of capital.

Project beta = 0.85 (using all equity comp)

Thus, $r_p = 4\% + 0.85(5\%) = 8.25\%$

22. **Plan:** Determine if CoffeeStop should use CoffeeStop's or BF Liquors' WACC for this analysis, and then estimate that WACC.

Execute: CoffeeStop should use the WACC of BF Liquors to evaluate this division, since it will be financed using the same weights, and the division has a risk more similar to BF than CoffeeStop. The cost of equity for BF is $3\% + 0.26 \times 6\% = 4.56\%$.

$$\begin{aligned} \text{WACC} &= (0.11)(4.8\%)(1 - 35\%) + (0.89)(4.56\%) \\ &= 4.40\% \end{aligned}$$

Evaluate: CoffeeStop should use BF Liquors' WACC, which is 4.40%.

23. **Plan:** Calculate the WACC of your computer sales division and the WACC of your software division.

Execute:

- a. To find the WACC of the computer sales division, we will calculate the WACC of Dell Computers.

The return on equity for Dell is $4.5\% + 1.21 \times 5\% = 10.55\%$. The pre tax return on debt for Dell is 6%. Dell has a market value of equity of \$67 billion and a market value of debt of \$0.7 billion.

$$\text{Dell's WACC is } \left(\frac{0.7}{67.7} \right) (6\%)(1 - 35\%) + \left(\frac{67}{67.7} \right) (10.55\%) = 10.48\%.$$

- b. The firm's WACC should be the weighted average of the divisional WACCs.

$$\begin{aligned} 12\% &= (40\%)(10.48\%) + (60\%)(\text{WACC}_{\text{software}}) \\ \text{WACC}_{\text{software}} &= \frac{12\% - (40\%)(10.48\%)}{60\%} \\ &= 13.01\% \end{aligned}$$

Evaluate: The estimated WACC for the computer sales division is 10.48%; the estimated WACC for the software division is 13.01%.

24. Plan: Calculate the NPV of the project.

Execute: The direct issuing costs should be included as a direct cost of the acquisition.
 $\text{NPV} = 36.36 - 7 = 29.36$ million.

Evaluate: Because the NPV is positive, they should still go ahead with the acquisition.

25. Plan: The best way to deal with the costs of external financing is to incorporate them directly into the NPV. The NPV of the project with external financing is the original NPV minus the cost of financing.

Execute:

$\$20 \text{ million in debt} \times 3\% = \$600,000$ in financing costs

$\text{NPV} = \$15 \text{ million} - \$600,000 = \$14.4 \text{ million}$

Evaluate:

Incorporating the transaction costs of seeking external financing lowers the NPV of the project by \$600,000 to \$14.4 million, but it is still a positive-NPV project.

Chapter 14

Raising Equity Capital

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** The implied price per share is the investment divided by the number of new shares. The post-money valuation is the implied price per share multiplied by the *total* number of shares of the company. Finally, your fractional ownership will equal your shares (5 million) divided by the new total shares (5,800,000).

Execute:

Implied price per share = $\$1,000,000 / 800,000 = \1.25

Post-money valuation = $\$1.25 \times 5,800,000 = \$7,250,000$

Your fractional ownership: $5,000,000 / 5,800,000 = 0.862$, or 86.2%

Evaluate:

In order to get new funding, you gave up 13.8% of your company in exchange for \$1 million in new capital. The higher the price you can get for new shares, the lower the amount of ownership you have to give up for a given amount of new funding.

2. **Plan:** The post-money valuation will be the total number of shares multiplied by the price paid by the VC. The percentage of the firm owned by the VC is her shares divided by the total number of shares. Your percentage will be your shares divided by the total shares, and the value of your shares will be the number of shares you own multiplied by the price the VC paid.

Execute:

- a. After the funding round, the founder's 8 million shares will represent 80% ownership of the firm. To solve for the new total number of shares (TOTAL):

$$8,000,000 = 0.80 \times \text{TOTAL}$$

So, $\text{TOTAL} = 10,000,000$ shares. If the new total is 10 million shares, and the venture capitalist will end up with 20%, then the venture capitalist must buy 2 million shares. Given the investment of \$1 million for 2 million shares, the implied price per share is \$0.50.

- b. After this investment, there will be 10 million shares outstanding, with a price of \$0.50 per share, so the post-money valuation is \$5 million.

Evaluate: Funding your firm with new equity capital, be it from an angel or venture capitalist, involves a trade-off—you must give up part of the ownership of the firm in return for the money you need to grow. The higher is the price you can negotiate per share, the smaller is the percentage of your firm you have to give up for a given amount of capital.

- 3. Plan:** Post-money valuation is implied price per share \times total shares (new and old). For (a) and (b), you must calculate the implied price per share (investment / shares received) for each offer and then calculate the post-money valuations.

For (c), you need to calculate the new total shares outstanding and divide your 10 million shares into that total. Subtracting your new ownership fraction from your old (100%) gives you the dilution.

For (d), divide the total dilution in each offer by the dollars received to get the dilution per dollar.

Execute:

- Implied price per share = \$3 million/1 million shares = \$3
Post-money valuation = \$3 \times 11 million shares = \$33 million
- Implied price per share = \$2 million/500,000 shares = \$4
Post-money valuation = \$4 \times 10,500,000 shares = \$42 million
- Offer 1 new fractional ownership: 10 million/11 million = 0.909. Dilution = 1 – 0.909 = 0.091.
Offer 2 new fractional: 10,000,000/10,500,000 = 0.952. Dilution = 1 – 0.952 = 0.048.
Difference in dilution = 0.091 – 0.048 = 0.043
- Offer 1: 0.091/\$3,000,000 = 0.000000030
Offer 2: 0.048 / \$2,000,000 = 0.000000024

Evaluate:

By offering a higher implied price per share, the second offer allows you to bring in more capital while suffering lower dilution. You can also see that the dilution per dollar of investment is lower for offer 2.

- 4. Plan:** The pre-money valuation will be the value of the prior shares outstanding at the price in the funding round. The post-money valuation will be the total number of shares multiplied by the price paid by the VC. The percentage of the firm owned by the VC is her shares divided by the total number of shares. Your percentage will be your shares divided by the total shares, and the value of your shares will be the number of shares you own multiplied by the price the VC paid.

Round	Price (\$)	Number of Shares
Series B	0.50	1,000,000
Series C	2.00	500,000
Series D	4.00	500,000

Execute:

- Before the Series D funding round, there are (5,000,000 + 1,000,000 + 500,000 = 6,500,000) shares outstanding. Given a Series D funding price of \$4.00 per share, the pre-money valuation is (6,500,000) \times \$4.00/share = \$26 million.
- After the funding round, there will be (6,500,000 + 500,000 = 7,000,000) shares outstanding, so the post-money valuation is (7,000,000) \times \$4.00/share = \$28,000,000.

Evaluate: Funding your firm with new equity capital, be it from an angel or venture capitalist, involves a trade-off—you must give up part of the ownership of the firm in return for the

money you need to grow. The higher is the price you can negotiate per share, the smaller is the percentage of your firm you have to give up for a given amount of capital.

5. **Plan:** The fraction of the firm that each investor owns can be determined as a percentage of the investor's total value to the number of total outstanding shares.

Execute: There are 7 million shares outstanding at the end of the Series D financing round. Therefore, Series B investors own

$$\frac{1,000,000}{7,000,000} = \frac{1}{7}$$

of the firm, while Series C and Series D investors each own

$$\frac{500,000}{7,000,000} = \frac{1}{14}$$

of the firm.

Evaluate: When a company founder decides to sell equity to outside investors for the first time, it is common practice for private companies to issue preferred stock rather than common stock to raise capital. Preferred stock issued by mature companies such as banks usually has a preferential dividend and seniority in any liquidation and sometimes special voting rights. Conversely, the preferred stock issued by young companies typically does not pay regular cash dividends. However, this preferred stock usually gives the owner an option to convert it into common stock on some future date, so it is often called convertible preferred stock.

6. **Plan:** The fraction of the firm that each investor owns can be determined as a percentage of the investor's total value to the number of total outstanding shares.

Execute: You will own $5,000,000/7,000,000 = 71.4\%$ of the firm after the last funding round.

Evaluate: When a company founder decides to sell equity to outside investors for the first time, it is common practice for private companies to issue preferred stock rather than common stock to raise capital. Preferred stock issued by mature companies such as banks usually has a preferential dividend and seniority in any liquidation and sometimes special voting rights. Conversely, the preferred stock issued by young companies typically does not pay regular cash dividends. However, this preferred stock usually gives the owner an option to convert it into common stock on some future date, so it is often called convertible preferred stock.

7. First, compute the cumulative total number of shares demanded at or above any given price:

Price	Cumulative Demand
14.00	100,000
13.80	300,000
13.60	800,000
13.40	1,800,000
13.20	3,000,000
13.00	3,800,000
12.80	4,200,000

The winning price should be \$13.40 because investors have placed orders for a total of 1.8 million shares at a price of \$13.40 or higher.

8. For investors to place orders for 2.3 million shares, the offer price will need to be \$13.20. The amount raised will be $(\$13.20) \times (2.3 \text{ million}) = \30.36 million .
9. **Plan:** If the IPO price is based on a price/earnings ratio that is similar to those for recent IPOs, then this ratio will equal the average of recent deals. Thus, to compute the IPO price based on the P/E ratio, we will first take the average P/E ratio from the comparison group and multiply it by Outdoor Recreation's total earnings. This will give us a total value of equity for Wagner. To get the per share IPO prices, we need to divide the total equity value by the number of shares outstanding after the IPO. The fraction of the firm that each investor owns can be determined as a percentage of the investor's total value to the number of total outstanding shares.

Execute:

- a. With a P/E ratio of 20.0x, and 2011 earnings of \$7.5 million, the total value of the firm at the IPO should be:

$$\frac{P}{7.5} = 20.0x \Rightarrow P = \$150 \text{ million}$$

There are currently $(500,000 + 1,000,000 + 2,000,000) = 3,500,000$ shares outstanding (before the IPO). At the IPO, the firm will issue an additional 6.5 million shares, so there will be 10 million shares outstanding immediately after the IPO. With a total market value of \$150 million, each share should be worth $\$150/10 = \15 per share.

- b. After the IPO, you will own 500,000 of the 10 million shares outstanding, or 5% of the firm.

Evaluate: As we found in Chapter 10, one can get different valuations depending on the type of multiple you use—you should not expect to get the same value from different ratios. Although the P/E ratio implies a share price of \$15 per share, the underwriters will probably establish an initial price range for the stock and then solicit feedback from potential institutional investors.

10. **Plan:** Under pricing is the difference between the first day closing price and the offering price. To figure out how much money the firm missed out on, multiply the dollar difference in price per share by the number of shares sold.

Execute: Under pricing = $\$17 - \$15 = \$2$. As a percent of the offering price, this is $\$2 / \$15 = 13.3\%$.

Forgone money: $\$2 \text{ per share} \times 10 \text{ million shares} = \20 million

Evaluate: Because the true market value of the shares was \$2 per share higher than the price at which they were sold through the underwriters, the firm sold them for too little, missing out on an additional \$20 million in capital it could have raised by pricing them at \$17 per share.

11. **Plan:** Calculate the initial return on Margoles stock and analyze the underpricing.

Execute:

- a. The initial return on Margoles Publishing stock is $(\$19.00 - \$14.00)/(\$14.00) = 35.7\%$.

- b. Who gains from the price increase? Investors who were able to buy at the IPO price of \$14/share see an immediate return of 35.7% on their investment. Owners of the other shares outstanding that were not sold as part of the IPO see the value of their shares increase. To the extent that the investors who were able to obtain shares in the IPO have other relationships with the investment banks, the investment banks may benefit indirectly from the deal through their future business with these customers.

Evaluate: Who loses from the price increase? The original shareholders lose because they sold stock for \$14.00 per share when the market was willing to pay \$19.00 per share.

- 12. Plan:** Calculate the total cost of going public.

Execute: The total dollar value of the IPO was $(\$14.00) \times (10 \text{ million}) = \140 million . The total cost of going public was $(0.07) \times (\$140 \text{ million}) = \9.8 million .

Evaluate: It cost Margoles Publishing \$9.8 million to go public.

- 13. Plan:** Calculate the dollar cost of the underwriter fees.

Execute: The total dollar value of the IPO was $(\$18.50) \times (4 \text{ million}) = \74 million . The spread equaled $(0.07) \times (\$74 \text{ million})$ or \$5.18 million.

Evaluate: It cost Chen Brothers, Inc. \$5.18 million in underwriter fees.

- 14. Plan:** First, we must compute the underwriting spread. Then we can compute the lowest price possible using the underwriting spread.

Execute: The proceeds to your firm, given an offer price of \$17.25 per share and an underwriting spread of 7%, is $(0.93) \times (\$17.25) \times (3 \text{ million}) = \$48,127,500$. In order for you to be indifferent between the two options, the offer price (with the 5% underwriting spread) would need to drop low enough so that you can raise \$48,127,500.

$$\begin{aligned} \$48,127,500 &= (\$X) \times (0.95) \times (3 \text{ million}) \\ \$X &= \frac{\$48,127,500}{(0.95) \times (3,000,000)} \\ &= \$16.89 \end{aligned}$$

The offer price can fall to \$16.89 before you would prefer to pay 7% to get \$17.25 per share.

Evaluate: Although the auction IPO does not provide the certainty of the firm commitment, it has the advantage of using the market to determine the offer price. It also reduces the underwriter's role, and consequently, fees.

- 15. Plan:** The percentage of the firm owned is the shares owned divided by the total number of shares. The percentage will be the shares divided by the total shares, and the value of your shares will be the number of shares you own multiplied by the price and VC paid.

Execute: If the firm sells 2 million primary shares at \$20 each, the firm will raise \$40 million and the total number of shares outstanding after the IPO will be 14 million. You will own 50% of the firm (7 million/14 million) after the IPO.

Evaluate: Funding your firm with new equity capital, be it from an angel or venture capitalist, involves a trade-off—you must give up part of the ownership of the firm in return for the money you need to grow. The higher is the price you can negotiate per share, the smaller is the percentage of your firm you have to give up for a given amount of capital.

- 16. Plan:** The percentage of the firm owned is the shares owned divided by the total number of shares. The percentage will be the shares divided by the total shares, and the value of your shares will be the number of shares you own multiplied by the price and VC paid.

Execute: If all of the shares sold are secondary shares from your holdings, the firm raises no money from the IPO. Your percentage ownership of the firm after the IPO will be 41.67% (5 million/12 million).

Evaluate: Funding your firm with new equity capital, be it from an angel or venture capitalist, involves a trade-off—you must give up part of the ownership of the firm in return for the money you need to grow. The higher is the price you can negotiate per share, the smaller is the percentage of your firm you have to give up for a given amount of capital.

- 17. Plan:** In order to know how much money will be raised, we need to compute how many total shares would be purchased if everyone exercises their rights. Then we can multiply it by the price per share to calculate the total amount raised.

Execute: In order to retain 50.1% ownership of the firm, you would need to hold $(0.501) \times (12 \text{ million}) = 6,012,000$ shares. Thus, you could sell up to 988,000 shares.

Evaluate: A firm's need for outside capital rarely ends at the IPO. Usually, profitable growth opportunities occur throughout the life of the firm, and in some cases it is not feasible to finance these opportunities out of retained earnings. Thus, more often than not, firms return to the equity markets and offer new shares for sale, or seasoned equity offerings.

- 18. Plan:** In order to know how much money will be raised, we need to compute how many total shares would be purchased if everyone exercises their rights. Then we can multiply it by the price per share to calculate the total amount raised.

Execute:

- The company sold 5 million shares at \$42.50 per share, so it raised $(\$42.50) \times (5,000,000) = \212.5 million. After underwriting fees, it will keep $212.5 \times (1 - 0.05) = \201.875 million.
- The gross proceeds from the venture capitalists' shares are $(\$42.50) \times (3,000,000) = \127.5 million. After underwriting fees, they will keep $127.5 \times (1 - 0.05) = \121.125 million.
So, in total, the SEO was worth $\$201.875 + \$121.125 = (\$42.50) \times (8,000,000) \times 0.95 = \323 million.
- If the stock price dropped 3% on the announcement of the SEO, the stock price would be \$41.23. After paying the underwriting fee, Metropolitan would receive $(\$41.23) \times (5,000,000) \times 0.95 = \$195,842,500$.

Evaluate: A firm's need for outside capital rarely ends at the IPO. Usually, profitable growth opportunities occur throughout the life of the firm, and in some cases it is not feasible to finance these opportunities out of retained earnings. Thus, more often than not, firms return to the equity markets and offer new shares for sale, or seasoned equity offerings.

- *19. Plan:** In order to compute the number of shares needed, we can set the total money raised equal to the underwriter spread multiplied by the offer price and the number of shares sold. In order to compute the percentage reduction in ownership, we can use the number of shares outstanding divided by the number of shares the firm must sell plus the number of shares outstanding.

Execute:

- a. Total money raised = $(1 - \text{underwriter spread}) \times (\text{offer price}) \times (\text{number of shares sold})$:

$$\begin{aligned} 100,000,000 &= (0.95) \times (\$50) \times (X) \\ X &= \frac{100,000,000}{0.95 \times 50} \\ &= 2,105,263 \end{aligned}$$

The firm would need to sell 2,105,263 shares to raise \$100 million.

- b. A 2% drop in the stock price would result in a stock price of $(98\%) \times (\$50) = \49 . Total money raised = $(1 - \text{underwriter spread}) \times (\text{offer price}) \times (\text{number of shares sold})$:

$$\begin{aligned} 100,000,000 &= (0.95) \times (\$49) \times (X) \\ X &= \frac{100,000,000}{0.95 \times 49} \\ &= 2,148,228 \end{aligned}$$

The firm would need to sell 2,148,228 shares to raise \$100 million.

- c. If there is no drop in the stock price upon the announcement of the SEO, the existing shareholders would own:

$$\frac{10,000,000}{12,105,263} = 0.8261 = 82.61\%.$$

This would be a 17.39% reduction in ownership of the firm.

If there is a 2% drop in the stock price, then the existing shareholders would own:

$$\frac{10,000,000}{12,148,228} = 0.8232 = 82.32\%$$

This would be a 17.68% reduction in ownership of the firm.

Evaluate: A firm's need for outside capital rarely ends at the IPO. Usually, profitable growth opportunities occur throughout the life of the firm, and in some cases it is not feasible to finance these opportunities out of retained earnings. Thus, more often than not, firms return to the equity markets and offer new shares for sale, or seasoned equity offerings.

20. Plan: Calculate how much money would be raised if all rights are exercised.

Execute: Investors will receive a total of 10 million rights. Because it takes 10 rights to purchase one share, they will be able to purchase 1 million shares. At a price of \$40/share, the company will be able to raise $(\$40/\text{share}) \times (1 \text{ million shares}) = \40 million in this offering.

Evaluate: If all rights are exercised, MacKenzie Corporation would raise \$40 million from the offering.

Chapter 15

Debt Financing

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Compute the closing fees and determine the proceeds from the loan.

Execute:

Fees: $200,000 \times 0.02 = 4000$

Total Proceeds: $200,000 - 4000 = \$196,000$

Evaluate: You will receive \$196,000 after paying the closing fee on your \$200,000 loan.

2. a. With fees of 2%, your net is 98% of the loan amount for the first option: $0.98(500,000) = 490,000$; with fees of 1%, your net is 99% of the loan amount for the second option: $0.99(500,000) = 495,000$.
- b. Because you pay interest on the gross loan amount (the principal of the loan), your interest on each option is calculated based on \$500,000. For the first option, your interest is $(0.04)(500,000) = 20,000$, but you only received 490,000, so your true rate of interest is $20,000/490,000 = 0.0408$, or 4.08%.

For the second option, it is your interest is $(0.045)(500,000) = 22,500$, so your true rate of interest is $22,500/495,000 = 0.0455$, or 4.55%

3. **Plan:** Compute the fees and the net proceeds you will receive from the bond offering.

Execute:

Fees: $100,000,000 \times 0.03 = 3,000,000$

Total Proceeds: $100,000,000 - 3,000,000 = \$97,000,000$

Evaluate: You will receive \$97,000,000 from the bond offering.

4. **Plan:** You have positive earnings (net income), so without any quick ratio requirement, you could pay up to \$70 million in dividends. However, you must check the quick ratio as well. Current assets = cash + receivables + inventory.

Execute:

Current assets = \$10 million + \$8 million + \$5 million = \$23 million

Quick ratio = (current assets – inventory)/current liabilities = (\$23 million – \$5 million)/\$19 million = \$18 million/\$19 million = 0.947

In order to pay dividends, you must raise your quick ratio to 1.1, which means your current assets net of inventory must be 1.1 times your current liabilities ($1.1 \times 19 = 20.9$). So you must use \$2.9 million of your earnings to increase your cash holdings to meet the quick ratio test. With \$12.9 million in cash instead of \$10 million, the ratio is:

$$(\$12.9 \text{ million} + \$8 \text{ million})/\$19 \text{ million} = 1.1$$

Thus, the maximum dividend would be \$70 million – \$2.9 million = \$67.1 million.

Evaluate:

The quick ratio requirement forced you to use some of your net income to increase your cash holdings, thus reducing the total earnings available to pay dividends.

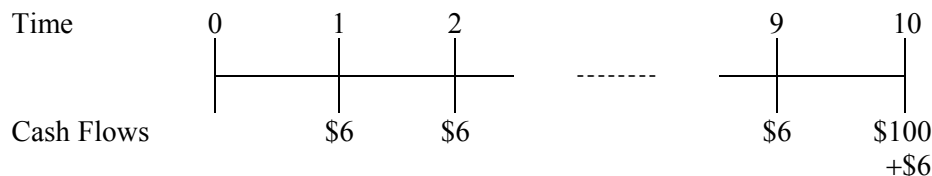
5. The new firm will have a NTA to debt ratio that is a weighted average of the ratios of your firm and the firm you are acquiring. The weights are your relative sizes. Because you are twice the size of the other firm, you will have a weight of 2/3, and it will have a weight of 1/3 in the new firm. The ratio for the combined firm will be: $(2/3)(2) + (1/3)(1.2) = 1.7333$, so you can acquire the firm without violating your covenant.



6. a. **Plan:** Create a timeline of the cash flows and compute the yield to maturity.

Execute:

Timeline:



The present value formula to be solved is:

$$102 = \frac{6}{\text{YTM}} \left(1 - \frac{1}{(1 + \text{YTM})^{10}} \right) + \frac{100}{(1 + \text{YTM})^{10}}$$

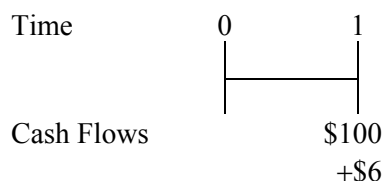
Using the annuity calculator: YTM = 5.73%

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	10		-102.00	6	100	
Solve for Rate:		5.732%				=RATE(10,6,-102,100)
Evaluate:	The yield to maturity is 5.73%.					

b. Plan: Create a timeline of the cash flows and compute the yield to call.

Execute: YTC:

Timeline:



The present value formula to be solved is:

$$102 = \frac{106}{1 + \text{YTC}} \Rightarrow \text{YTC} = \frac{106}{102} - 1 = 3.92\%$$

Evaluate: The yield to call is 3.92%.

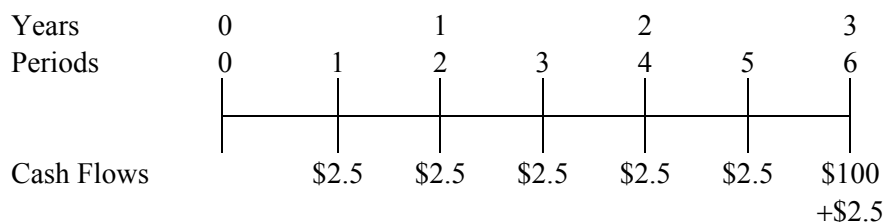
c. Because the bond is trading at a premium, the likelihood of call is high, and the yield to worst is the YTC: 3.92%.



7. a. Plan: Create a timeline of the cash flows and compute the yield to maturity.

Execute:

Timeline:



The present value formula to be solved is:

$$99 = \frac{2.5}{i} \left(1 - \frac{1}{(1+i)^6} \right) + \frac{100}{(1+i)^6}$$

Using the annuity calculator:

$$i = 2.683\%$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	6		-99.00	2.5	100	
Solve for Rate:		2.68%				=RATE(6,2.5,-99,100)

So, because YTM are quoted as APRs:

$$\text{YTM} = i \times 2 = 2.68\% \times 2 = 5.36\%$$

Evaluate: The yield to maturity on the bond is 5.37%.

b. Plan: Create a timeline of the cash flows and compute the yield to call.

Execute: YTC:

Timeline:

Years	0	1	2		
Periods	0	1	2	3	4
Cash Flows		\$2.5	\$2.5	\$2.5	\$100 +\$2.5

The present value formula to be solved is:

$$99 = \frac{2.5}{i} \left(1 - \frac{1}{(1+i)^4} \right) + \frac{100}{(1+i)^4}$$

Using the annuity calculator:

$$i = 2.77\%$$

	N	I/Y	PV	PMT	FV	Excel Formula
Given:	4		-99.00	2.5	100	
Solve for Rate:		2.77%				=RATE(4,2.5,-99,100)

Because YTM (and therefore YTC) are quoted as APRs:

$$\begin{aligned} \text{YTC} &= i \times 2 \\ &= 5.54\% \end{aligned}$$

Evaluate: The yield to call is 5.54%.

c. Because the bond is trading at a discount, the likelihood of call is low, and the yield to worst is the YTM: 5.36%.

8. Plan: Compute the conversion ratio of the bond.

Execute: The conversion price is the face value of the bond divided by the conversion ratio. In this case:

$$\begin{aligned} P &= \frac{\text{Face value}}{\text{Conversion ratio}} \\ &= \frac{\$10,000}{450} \\ P &= \$22.22 \end{aligned}$$

Evaluate: The conversion ratio for this bond is \$22.22.

- 9. Plan:** The conversion ratio gives the number of shares received in conversion. You can calculate the benefit of conversion by multiplying the number of shares by the price per share. The benefit must exceed the cost, which is giving up the bond as well as paying the transaction costs of 3%.

Execute:

Number of shares received = 40

Total cost of conversion = $\$1,000 \times 1.03 = \$1,030$

Required price per share = $\$1,030/40 = \25.75

Evaluate:

If the price per share is \$25.75, you are just indifferent to converting. At any price above \$25.75, you get a greater benefit than the cost of converting, so you prefer to convert.

- 10.** It has to make sense for you to take a bond with a face value of \$1,000 and convert it into shares worth \$35, so you need to expect to get at least $\$1,000 / \$35 = 28.57$ shares. The smallest whole number conversion ratio that makes conversion sensible is 29.
- 11. Plan:** According to Table 15.7, if converted, each bond is worth 107.565 shares of Real Networks stock, and the call price is 100% of face value of the bond.

The value of the shares per \$1,000 is then $107.565 \times$ the share price. The bondholders will convert when the bond is called if the value of conversion exceeds the call price.

Execute:

- At \$6.74 per share, the value to bondholders per \$1,000 bond is $(107.565) \times (6.74) = \$1,043.38$.
- The call price is 100% of face value, so it is \$1,000.
- Bondholders will convert into shares if you call the bonds, as the value of converting is greater than the value received under the call.

Evaluate: By calling the bonds, Real Networks can force conversion—meaning that the only rational thing for bondholders to do is convert. Thus, rather than having to pay back the bonds, Real will be able to issue new shares to the bondholders instead.

Chapter 16

Capital Structure

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** In order to calculate the NPV of the project, we must first compute the free cash flows for that year by calculating the average of the two likely scenarios for cash flows that year. We can then compute the NPV using the NPV formula. Knowing the free cash flows, the discount rate, and the initial investment, we can compute the NPV as well as the equity value. Finally, we can compute the cash flows of the levered equity by computing the risk-free rate of the debt payments and subtracting that from the two likely scenarios for the cash flows used in part (a). Finally, the initial value of the project can be found by subtracting the debt payments of the project from the equity value.

Execute:

$$\begin{aligned} \text{a.} \quad E[C(1)] &= \frac{1}{2}(130,000 + 180,000) \\ &= 155,000 \\ \text{NPV} &= \frac{155,000}{1.20} - 100,000 \\ &= 129,167 - 100,000 \\ &= \$29,167 \end{aligned}$$

$$\text{b. Equity value} = PV(C(1)) = \frac{155,000}{1.20} = 129,167$$

$$\text{c. Debt payments} = 100,000, \text{ equity receives } 20,000 \text{ or } 70,000$$

Initial value, by MM, is $129,167 - 100,000 = \$29,167$.

Evaluate: The NPV rule states to accept a project with positive NPV, such as this project; therefore all else being equal, the company should undertake the project.

2. **Plan:** We can find the total market value of the firm without leverage by computing the total value of equity knowing the \$2 million in initial capital and the \$2 million needed to fund your research. We can compute the fraction of the firm's equity you will need to sell to raise the additional \$1 million you need using the total value of the firm and the new value of equity after borrowing to get the percentage of equity that must be sold. Finally, we can compute the firm's value of equity in both cases, knowing the fraction of the firm's equity you will need to sell in both cases.

Execute:

- a. Total value of equity = $2 \times \$2 \text{ m} = \4 m .
- b. MM says the total value of firm is still \$4 million. \$1 million of debt implies the total value of equity is \$3 million. Therefore, 33% of equity must be sold to raise \$1 million.
- c. In (a), $50\% \times \$4 \text{ M} = \2 M . In (b), $2/3 \times \$3 \text{ M} = \2 M . Thus, in a perfect market, the choice of capital structure does not affect the value to the entrepreneur.

Evaluate: In this case, changing the capital structure does not affect the value to the owner of the firm, and therefore the owners have more flexibility with their capital structure.

3. **Plan:** We can use Eq. 16.1 to compute the current market value of Acort's equity. To determine its expected return, we will compute the cash flows to equity. The cash flows to equity are the cash flows of the firm net of the cash flows to debt (repayment of principal plus interest).

Execute:

- a. $E[\text{Value in 1 year}] = 0.8(50) + 0.2(20) = 44$

$$E = \frac{44}{1.10} = \$40 \text{ m.}$$

- b. $D = \frac{20}{1.05} = 19.048$. Therefore,

$$\begin{aligned} E &= 40 - 19.048 \\ &= \$20.952 \text{ m} \end{aligned}$$

- c. Without leverage,

$$\begin{aligned} r &= \frac{44}{40} - 1 \\ &= 10\% \end{aligned}$$

with leverage,

$$\begin{aligned} r &= \frac{44 - 20}{20.952} - 1 \\ &= 14.55\% \end{aligned}$$

- d. Without leverage,

$$\begin{aligned} r &= \frac{20}{40} - 1 \\ &= -50\% \end{aligned}$$

with leverage,

$$\begin{aligned} r &= \frac{0}{20.952} - 1 \\ &= -100\% \end{aligned}$$

Evaluate: The current market value of Acort's equity when unlevered is nearly double the current market value of Acort's equity when levered. The expected return is greater with debt than without, yet the lowest possible realized return of Acort's equity is less when unlevered as opposed to levered.

- *4. **Plan:** We can compute the debt payments and equity dividends for each firm using the capital structure of each firm. We can use Eq. 16.1 to compute the unlevered equity and levered equity of both firms.

Execute:

a.

FCF	ABC		XYZ	
	Debt Payments	Equity Dividends	Debt Payments	Equity Dividends
\$ 800	0	800	500	300
\$ 1000	0	1,000	500	500

- b. Unlevered Equity = Debt + Levered Equity. Buy 10% of XYZ debt and 10% of XYZ equity, get $50 + (30,50) = (80,100)$.
- c. Levered Equity = Unlevered Equity + Borrowing. Borrow \$500, buy 10% of ABC, receive $(80,100) - 50 = (30, 50)$.

Evaluate: MM Proposition I states that in a perfect capital market, the total value of a firm is equal to the market value of the free cash flows generated by its assets and is not affected by its choice of capital structure. By adding leverage, the returns of the unlevered firm are effectively split between low-risk debt and much higher risk levered equity. Returns of levered equity fall twice as fast as those of unlevered equity if the cash flows decline. Leverage increases the risk of equity even when there is no risk that the firm will default.

5. **Plan:** We can use Eq. 16.3 to compute the expected return of equity in both cases.

Execute:

- a. $r_e = r_u + d/e(r_u - r_d) = 12\% + 0.50(12\% - 6\%) = 15\%$
- b. $r_e = 12\% + 1.50(12\% - 8\%) = 18\%$
- c. Returns are higher because risk is higher—the return fairly compensates for the risk. There is no free lunch.

Evaluate: With no debt, the WACC is equal to the unlevered equity cost of capital. As the firm borrows at the low cost of capital for debt, its equity cost of capital rises according to Eq. 16.3. The net effect is that the firm's WACC is unchanged. As the amount of debt increases, the debt becomes more risky because there is a chance the firm will default; as a result, the debt cost of capital also rises.

6. **Plan:** We can use Eq. 16.3 to compute the cost of equity using the cost of debt, using 95% equity (E) and 5% debt (D). Its unlevered cost of equity, r_U , is 9.2%.

Execute: At a cost of debt of 6%:

$$\begin{aligned}r_E &= r_U + \frac{D}{E}(r_U - r_D) \\r_E &= 0.092 + \frac{0.05}{0.95}(0.092 - 0.06) \\&= 0.0937 \\&= 9.37\%\end{aligned}$$

Evaluate: With no debt, the WACC is equal to the unlevered equity cost of capital. As the firm borrows at the low cost of capital for debt, its equity cost of capital rises according to Eq. 16.3. The net effect is that the firm's WACC is unchanged. As the amount of debt increases, the debt becomes more risky because there is a chance that the firm will default; as a result, the debt cost of capital also rises.

7. **Plan:** We can find the net income of the firm using the EBIT, interest expense, and the corporate tax rate. We can compute the interest tax shield using Eq. 16.4.

Execute:

- Net income = EBIT – Interest – Taxes = $(325 - 125) \times (1 - 0.40) = \120 million
- Net income + Interest = $120 + 125 = \$245$ million
- Net income = EBIT – Taxes = $325 \times (1 - 0.40) = \195 million. This is $245 - 195 = \$50$ million lower than part (b).
- Interest tax shield = $125 \times 40\% = \$50$ million

Evaluate: The gain to investors from the tax deductibility of interest payments is referred to as the interest tax shield. The interest tax shield is the additional amount that a firm would have paid in taxes if it did not have leverage but can instead pay to investors.

8. **Plan:** We can find the net income of the firm using the EBIT, interest expense, and the corporate tax rate.

Execute:

- Net income will fall by the after-tax interest expense to $\$20.750 - 1 \times (1 - 0.35) = \20.10 million.
- Free cash flow is not affected by interest expenses.

Evaluate: Leverage merely changes the allocation of cash flows between debt and equity, without altering the total cash flows of the firm in a perfect capital market. In a perfect capital market, the total value of a firm is equal to the market value of the free cash flows generated by its assets and is not affected by its choice of capital structure.



9. Braxton Enterprises currently has debt outstanding of \$35 million and an interest rate of 8%. Braxton plans to reduce its debt by repaying \$7 million in principal at the end of each year for the next five years. If Braxton's marginal corporate tax rate is 40%, what is the interest tax shield from Braxton's debt in each of the next five years?

Year	0	1	2	3	4	5
Debt	35	28	21	14	7	0
Interest		2.8	2.24	1.68	1.12	0.56
Tax Shield		1.12	0.896	0.672	0.448	0.224

10. **Plan:** We can use Eq. 16.5 to compute the present value of the tax shield.

Execute:

$$PV(\text{Interest Tax Shield}) = T_c \times D$$

$$PV(\text{Interest Tax Shield}) = 35\% \times (\$300 \text{ billion} \times 13\%) = \$13.65 \text{ billion}$$

Evaluate: We know that in perfect capital markets, financing transactions have an NPV of zero. However, the interest tax deductibility makes this a positive-NPV transaction for the firm. The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt. There is an important tax advantage to the use of debt financing.

11. **Plan:** We can use Eq. 16.3 to compute the value of the firm's equity and debt. We can use our answers in parts (b) and (c) to compute the percentage of the value of debt.

Execute:

- a. Net income = $1000 \times (1 - 40\%) = \600 . Thus, equity holders receive dividends of \$600 per year with no risk.

$$E = \frac{600}{5\%} = \$12,000$$

- b. Net income = $(1000 - 500) \times (1 - 0.40) = \$300 \Rightarrow E = 300/5\% = \6000 . Debt holders receive interest of \$500 per year $\Rightarrow D = \$10,000$.

- c. With leverage = $6,000 + 10,000 = \$16,000$
 Without leverage = \$12,000
 Difference = $16,000 - 12,000 = \$4,000$

- d. $\frac{4000}{10,000} = 40\% = \text{corporate tax rate}$

Evaluate: MM Proposition I states that in a perfect capital market, the total value of a firm is equal to the market value of the free cash flows generated by its assets and is not affected by its choice of capital structure. By adding leverage, the returns of the unlevered firm are effectively split between low-risk debt and much higher risk levered equity. Returns of levered equity fall twice as fast as those of unlevered equity if the cash flows decline. Leverage increases the risk of equity even when there is no risk that the firm will default.



- 12. Plan:** We must compute the value of the tax shield in each year and then compute the present value of the tax shields.

Execute:

Year	0	1	2	3	4	5
Debt	100	75	50	25	0	0
Interest		10	7.5	5	2.5	0
Tax Shield		4	3	2	1	0
PV	\$8.30					

Evaluate: The present value of the annual tax shields is \$8.30 million.

- 13. Plan:** We can use Eq. 16.4 to compute the interest tax shield. We can use Eq. 16.5 to compute the present value of the interest tax shield.

Execute:

- Interest tax shield = $\$10 \times 6\% \times 35\% = \0.21 million.
- $PV(\text{Interest tax shield}) = \frac{\$0.21}{0.06} = \$3.5$ million.
- Interest tax shield = $\$10 \times 5\% \times 35\% = \0.175 million.

$$PV = \frac{\$0.175}{0.05} = \$3.5 \text{ million}$$

Evaluate: We know that in perfect capital markets, financing transactions have an NPV of zero. However, the interest tax deductibility makes this a positive-NPV transaction for the firm. The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt. There is an important tax advantage to the use of debt financing.

- 14. Plan:** We can use Eqs. 16.2 and 16.8 to calculate the pretax and after-tax WACCs, respectively. $E/(E + D) = 2/3$ and $D/(E + D) = 1/3$. $r_E = 0.12$ and $r_D = 0.07$. The tax rate is 35%.

Execute:

- $r_{\text{wacc}} = \frac{E}{E + D}r_E + \frac{D}{E + D}r_D(1 - \tau_c) = \frac{2}{3}(0.12) + \frac{1}{3}(0.07) = 0.1033$
- $r_{\text{wacc}} = \frac{E}{E + D}r_E + \frac{D}{E + D}r_D(1 - \tau_c) = \frac{2}{3}(0.12) + \frac{1}{3}(0.07)(1 - 0.35) = 0.0952$

Evaluate:

The WACCs differ only by the effect of the tax deductibility of interest, which acts only on the debt portion of the cost of capital. So, although the deduction lowers the effective after-tax cost of debt by 35% to about 0.046, the overall WACC only decreases by 0.008 because only one third of Rogot's capital is debt.

15. Plan: We can use Eq. 16.2 to compute the firm's WACC.

Execute:

a. $E = \$15 \times 30 = \450 million. $D = \$150$ million.

$$\begin{aligned}\text{Pretax WACC} &= \frac{450}{600}10\% + \frac{150}{600}5\% \\ &= 8.75\%\end{aligned}$$

$$\text{b. WACC} = \frac{450}{600}10\% + \frac{150}{600}5\%(1 - 35\%) = 8.3125\%$$

Evaluate: When we compute the WACC without taxes, we refer to it as the firm's pretax WACC, which is unchanged and remains equal to the firm's unlevered cost of capital. There are two offsetting effects of leverage: We finance a larger fraction of the firm with debt, which has a lower cost of capital, but at the same time adding leverage raises the firm's equity cost of capital. Fundamentally, the firm's total risk has not changed; therefore, these two effects should exactly cancel out and leave the firm's WACC unchanged.

16. Plan: We can use Eq. 16.2 to compute the fraction of the firm's value financed by debt. We can compute the amount the interest tax shield from the firm's debt that will lower the WACC using the value financed by debt, the interest on debt, and the corporate tax rate.

Execute:

$$\begin{aligned}\frac{D}{E + D} &= \frac{0.65}{1.65} \\ &= 0.394\end{aligned}$$

Therefore,

$$\text{WACC} = \text{Pretax WACC} - 0.394(7\%)(0.40) = \text{Pretax WACC} - 1.1\%$$

So, it lowers it by 1.1%.

Evaluate: When we compute the WACC without taxes, we refer to it as the firm's pretax WACC, which is unchanged and remains equal to the firm's unlevered cost of capital. There are two offsetting effects of leverage: we finance a larger fraction of the firm with debt, which has a lower cost of capital, but at the same time adding leverage raises the firm's equity cost of capital.

17. Plan: We can use Eq. 16.1 to compute the value of Milton Industries with and without leverage.

Execute:

$$\text{a. } V^U = \frac{5}{0.15} = \$33.33 \text{ million}$$

$$\text{b. } V^L = V^U + \tau_c D = 33.33 + 0.35 \times 19.05 = \$40 \text{ million}$$

Evaluate: When the firm has no debt, the cash flows paid to equity holders correspond to the free cash flows generated by the firm's assets. When the firm has debt, these cash flows are

divided between debt and equity holders. However, with perfect capital markets, the total amount paid to all investors still corresponds to the free cash flows generated by the firm's assets. Therefore, the value of the unlevered firm must equal the total value of the levered firm, which is the combined value of its debt and levered equity.

- 18. Plan:** If its pretax WACC remains the same, as it should for a pure capital structure change, you can use Eq. 16.9 to calculate the after-tax WACC accounting for the reduction due to the interest tax shield.

Execute:

$$r_{WACC} = \text{Pretax WACC} - \frac{D}{E + D} r_D \tau = 0.15 - 0.5 \times 0.09 \times 0.35 = 0.13425$$

Evaluate: The tax deductibility of debt lowers its WACC by more than 1.5%.

- *19. Plan:** Calculate answers to the several questions asked in the problem.

Execute:

- Assets = Equity = $\$7.50 \times 20 = \150 million
- Assets = 150 (existing) + 50 (cash) + $40\% \times 50$ (tax shield) = \$220 million
- $E = \text{Assets} - \text{Debt} = 220 - 50 = \170 million.

$$\begin{aligned} \text{Share price} &= \frac{\$170 \text{ million}}{20} \\ &= \$8.50 \end{aligned}$$

Kurz will repurchase

$$\frac{50}{8.50} = 5.882 \text{ million shares.}$$

- Assets = 150 (existing) + $40\% \times 50$ (tax shield) = \$170 million.

$$\begin{aligned} \text{Debt} &= \$50 \text{ million} \\ E &= A - D = 170 - 50 = \$120 \text{ million} \\ \text{Share price} &= \frac{\$120}{20 - 5.882} = \$8.50/\text{share} \end{aligned}$$

Evaluate: Several values are calculated with a resulting share price of \$8.50.

- 20. Plan:** Compute the NPV of the investment and the price of a Kohwe share today.

Execute:

$$\begin{aligned} \frac{10}{0.08} - 50 &= \$75 \text{ million} \\ \frac{75}{5} &= \$15/\text{share} \end{aligned}$$

Evaluate: The NPV of the investment is \$75 million and a share of Kohwe stock should sell for \$15.

- 21. Plan:** Estimate the value of a Kohwe equity share with more debt financing.

Execute:

$$\frac{75 + 0.4 \times 50}{5} = \$19/\text{share}$$

Evaluate: With more debt financing, a Kohwe equity share would sell for \$19 reflecting the tax shields created by debt financing.

- 22. Plan:** Compute the value of a Kohwe share with financial distress costs.

Execute:

$$\frac{\frac{9}{0.08} - 50 + 0.4 \times 50}{5} = \$16/\text{share}$$

Evaluate: A Kohwe with financial distress costs would sell for \$16.

***23. a.** Share price = $\frac{25}{10} = \$2.50$ per share

- b. Just before the share repurchase:

$$\text{Assets} = 25 \text{ (existing)} + 10 \text{ (cash)} + 35\% \times 10 \text{ (tax shield)} = \$38.5 \text{ billion}$$

$$E = 38.5 - 10 = 28.5 \text{ } P\text{share price} = \frac{28.5}{10} = \$2.85 / \text{share}$$

Therefore, shareholders will not sell for \$2.75 per share.

- c. Assets = 25 (existing) + 35% 10 (tax shield) = \$28.5 billion

$$E = 28.5 - 10 = 18.5 \text{ billion}$$

$$\text{Shares} = 10 - \frac{10}{3} = 6.667 \text{ billion; Share price} = \frac{18.5}{6.667} = \$2.775 \text{ share}$$

- d. From (b), fair value of the shares prior to repurchase is \$2.85. At this price, Rally will have

$$10 - \frac{10}{2.85} = 6.49 \text{ million shares outstanding, which will be worth } \frac{18.5}{6.49} = \$2.85 \text{ after the}$$

repurchase. Therefore, shareholders will be willing to sell at this price.

- 24.** With its current leverage, Impi Corporation will have net income next year of \$4.5 million. If Impi's corporate tax rate is 35% and it pays 8% interest on its debt, how much additional debt can Impi issue this year and still receive the benefit of the interest tax shield next year?

$$\text{Net income of \$4.5 million} \Rightarrow \frac{4.5}{1 - 0.35} = \$6.923 \text{ million in taxable income.}$$

Therefore, Impi can increase its interest expenses by \$6.923 million, which corresponds to debt of:

$$\frac{6.923}{0.08} = \$86.5 \text{ million.}$$

- 25. Plan:** Compute the value of a share of Hawar equity with tax subsidies from debt, and compute the financial distress costs Hawar will incur.

Execute:

- a. $0.3 \times \frac{20}{10} + 5.5 = \$6.10/\text{share}$
 b. $(6.1 - 5.75) \times 10 = \3.5 million

Evaluate: After issuing debt and buying back shares, Hawar stock should sell for \$6.10. The financial distress costs should be \$3.5 million.

- 26. Plan:** Compute the value of Marpor without leverage and with leverage.

Execute:

- a. $r = 5\% + 1.1 \times (15\% - 5\%) = 16\%$
 $V = \frac{16}{0.16} = \$100 \text{ million}$
 b. $r = 5\% + 1.1 \times (15\% - 5\%) = 16\%$
 $V = \frac{15}{0.16} + 0.35 \times 40 = \107.75 million

Evaluate: Without leverage, Marpor is valued at \$100 million. With leverage, it is valued at \$107.75 million.

- *27. a.**

$$FCF = EBIT \times (1 - \tau) + Dep - Capex - \Delta NWC = 15 \times (1 - 0.35) + 3 - 6 = 6.75$$

$$E = \frac{6.75}{10\% - 8.5\%} = \$450 \text{ million}$$

- b. Interest expense of \$15 million \Rightarrow debt of $\frac{15}{0.08} = \$187.5 \text{ million}$.
 c. No. The most they should borrow is 187.5 million; there is no interest tax shield from borrowing more.

- 28.** If Dynron has no debt or if in all scenarios Dynron can pay the debt in full, equity holders will only consider the project's NPV in making the decision. If Dynron is heavily leveraged, equity holders will also gain from the increased risk of the new investment.

- 29. Plan:** We can find the net income of the firm using the EBIT, interest expense, and the corporate tax rate. We can use Eq. 16.2 to compute the fraction of the firm's value financed by debt.

Execute:

- a. Equity = 0
 Debt = $\frac{10}{1.1} = \$9.09 \text{ million}$

$$\text{b. NPV} = \frac{25}{1.1} - 20 = \$2.73 \text{ million}$$

$$\text{c. Debt} = \frac{15}{1.1} = \$13.64 \text{ million}$$

$$\text{Equity} = \frac{35 - 15}{1.1} = \$18.18 \text{ million}$$

Equity holders will not be willing to accept the deal because for them it is a negative NPV investment ($18.18 - 20 < 0$).

Evaluate: When we compute the WACC without taxes, we refer to it as the firm's pretax WACC, which is unchanged and remains equal to the firm's unlevered cost of capital. There are two offsetting effects of leverage: We finance a larger fraction of the firm with debt, which has a lower cost of capital, but at the same time adding leverage raises the firm's equity cost of capital.

- *30. Plan:** Compute the expected payoff of each project. Compute the expected payoff to equity holders from each project and compute the agency costs.

Execute:

- a. $E(A) = \$75$ million
 - i. $E(B) = 0.5 \times 140 = \70 million
 - ii. $E(C) = 0.1 \times 300 + 0.9 \times 40 = \66 million
 - iii. Project A has the highest expected payoff for equity holders.
- b. $E(A) = 75 - 40 = \$35$ million
 - i. $E(B) = 0.5 \times (140 - 40) = \50 million
 - ii. $E(C) = 0.1 \times (300 - 40) + 0.9 \times (40 - 40) = \26 million
 - iii. Project B has the highest expected payoff for equity holders.
- c. $E(A) = \$0$ million
 - i. $E(B) = 0.5 \times (140 - 110) = \15 million
 - ii. $E(C) = 0.1 \times (300 - 110) = \19 million
 - iii. Project C has the highest expected payoff for equity holders.

With \$40 million in debt, management will choose Project B, which has an expected payoff for the firm that is $75 - 70 = \$5$ million less than Project A. Thus, the expected agency cost is \$5 million.

With \$110 million in debt, management will choose Project C, resulting in an expected agency cost of $75 - 66 = \$9$ million.

Evaluate: The calculations show that the project to be accepted is affected by the amount of debt financing.

- *31. Plan:** We can compute the fraction of the firm's equity you will need to sell to raise the additional \$30 million you need using the total value of the firm and the new value of equity after borrowing to get the percentage of equity that must be sold. Finally, we can compute the

firm's value of equity in both cases knowing the fraction of the firm's equity you will need to sell in both cases.

Execute:

- Market value of firm assets = $30/(2/3) = \$45$ million. With debt of \$20 million, equity is worth $45 - 20 = 25$, so you will need to sell $10/25 = 40\%$ of the equity.
- Given debt D , equity is worth $45 - D$. Selling 50% of equity, together with debt must raise \$30 million: $5 \times (45 - D) + D = 30$. Solve for $D = \$15$ million.

Evaluate: With no debt, the WACC is equal to the unlevered equity cost of capital. As the firm borrows at the low cost of capital for debt, its equity cost of capital rises according to Eq. (16.3). The net effect is that the firm's WACC is unchanged. As the amount of debt increases, the debt becomes more risky because there is a chance the firm will default; as a result, the debt cost of capital also rises.

- *32. Plan:** Determine the benefits of issuing debt.

Execute:

- In addition to tax benefits of leverage, debt financing can benefit Empire by reducing wasteful investment.
- Net income will fall by $\$1 \times 0.65 = \0.65 .
Because 10% of net income will be wasted, dividends and share repurchases will fall by $\$0.65 \times (1 - 0.10) = \0.585 .
- Pay \$1 in interest, give up \$0.585 in dividends and share repurchases \Rightarrow Increase of $1 - 0.585 = \$0.415$ per \$1 of interest.

Evaluate: Issuing debt can have multiple benefits to a firm.

- *33. Plan:** Do the calculations to answer the several questions asked in the problem.

Execute:

- Borrowing has a net cost of \$20 million, or $\$20/\$20 = \$0.20$ per share.
Selling $500/13.50 = 37$ million shares at a premium of \$1 per share has a benefit of \$37 million, or $37/137 = \$0.27$ per share, that is

$$\left(\frac{12.50 \times 100 + 500}{100 + \frac{500}{13.50}} = 12.77 = 12.50 + 0.27 \right)$$

Therefore, issue equity.

Borrowing has a net cost of \$20 million, or $\$20/100 = \0.20 per share. Selling $500/13.50 = 37$ million shares at a discount of \$1 per share has a cost of \$37 million, or $37/137 = \$0.27$ per share. Therefore, issue debt.

- If IST issues equity, investors would conclude IST is overpriced, and the share price would decline to \$12.50.
- If IST issues debt, investors would conclude IST is undervalued, and the share price would rise to \$14.50.

- d. If there are no costs from issuing debt, then equity is only issued if it is overpriced. But knowing this, investors would only buy equity at the lowest possible value for the firm. Because there would be no benefit to issuing equity, all firms would issue debt.

Evaluate: The decision to issue debt or equity securities involves considering numerous issues by a firm.

Chapter 17

Payout Policy

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

- 1. Plan:** Determine the ex-dividend day and the last day that an investor can purchase the stock and receive the dividend. The last day to buy and still get the dividend must be three business days before the record date. The record date is Monday, April 5, 2010. The ex-dividend day is the first day that buying the stock will not entitle you to the dividend.

Execute:

- a. April 1
- b. March 31

Evaluate: An investor who purchases the stock on April 1 will receive the dividend; an investor who purchases the stock on April 2 will not receive the dividend.

- 2. Plan:** Calculate the first ex-dividend day price.

Execute: Assuming perfect markets, the first ex-dividend price should drop by exactly the dividend payment. Thus, the first ex-dividend price should be \$49 per share.

Evaluate: In a perfect capital market, the first price of the stock on the ex-dividend day should be the closing price on the previous day less the amount of the dividend.

- 3. Plan:** ECB has a market capitalization of \$20 million ($\20×1 million shares). If it repurchases shares at the market price, it will need to pay $\$20 \times 100,000 = \2 million.

Execute:

Its new market capitalization will be \$18 million. (It started with \$20 million and distributed \$2 million through the repurchase.)

Its share price will stay at \$20 (\$18 million/900,000 shares).

Evaluate: As long as the company repurchases its shares at the market price, the price will not change after the repurchase. This is because buying shares at the market price is a zero-NPV investment—it has neither created nor destroyed value.

- 4. Plan:** Compute the changes in the balance sheet and determine the new leverage ratio.

Execute:

- Both the cash balance and shareholder equity will drop by \$20 million.
- After the repurchase, equity will be \$280 million, and debt is still \$200 million. The debt-to-equity ratio will be $200/280 = 71.4\%$.

Evaluate: Cash and shareholder equity will both decline by \$20 million on the balance sheet. The new leverage ratio will be 71.4%.

- 5. Plan:** Determine the present value of the annuity of dividends.

Execute: The present value of the perpetuity should be \$20 million with a discount rate of 10%.

Evaluate: The dividend payments should be $(\$20 \text{ million}/0.10)$ \$2.00 million per year in perpetuity.

$$\begin{aligned} \$20 \text{ million} &= \frac{X}{0.10} \\ X &= \$2 \text{ million} \end{aligned}$$

- 6. Plan:** Make the calculations requested in the problem.

Execute:

- \$1 billion/20 million shares = \$50 per share
- \$100 million/\$50 per share = 2 million shares
- If markets are perfect, then the price right after the repurchase should be the same as the price immediately before the repurchase. Thus, the price will be \$50 per share.

Evaluate: What will the price per share of EJH be right before the repurchase? \$50 per share

How many shares will be repurchased? 2 million shares

What will the price per share of EJH be right after the repurchase? \$50 per share

- 7. Plan:** Make the calculations requested in the problem.

Execute:

- The dividend payoff is $\$250/\$500 = \$0.50$ on a per share basis. In a perfect capital market the price of the shares will drop by this amount to \$14.50.
- \$15
- Both are the same.

Evaluate: What is the ex-dividend price of a share in a perfect capital market? \$14.50

If the board instead decided to use the cash to do a one-time share repurchase, in a perfect capital market what is the price of the shares once the repurchase is complete? \$15.00

In a perfect capital market, which policy (in part [a] or [b]) makes investors in the firm better off? Both policies would leave the firm equally well off.

- 8. Plan:** Determine what you have to do to maintain your same position in a firm that decides to do a share repurchase.

Execute: If you sell 0.5/15 of one share, you receive \$0.50, and your remaining shares will be worth \$14.50, leaving you in the same position as if the firm had paid a dividend.

Evaluate: If you sell \$0.50 of stock, you would be in the same position as having received a dividend.

- 9. Plan:** Determine the price of HNH stock with a \$2.00 dividend. Then compute the stock price if HNH suspends the dividend payments and instead repurchases shares.

Execute:

- a. $P = \$1.60/0.12 = \13.33
- b. $P = \$2/0.12 = \16.67

Evaluate: HNH with a dividend will sell for \$13.33. If HNH suspends the dividend and uses the \$2.00 per share to repurchase shares, the stock will sell for \$16.67. The increased value of the repurchase policy comes from the fact that dividends are taxed and capital gains are not.

- 10. Plan:** Compute the after-tax income from each and compare.

Execute:

- a. Table 17.2 shows that in 2010, the capital gains tax rate was 15%, and the dividend tax rate was 15%. At those rates, tax on a \$10 capital gain is \$1.50, and the tax on a \$10 special dividend is \$1.50. The after-tax income for both will be \$8.50.
- b. If the capital gains tax rate is 20%, the tax on a \$10 capital gain is \$2.00, and the after-tax income is \$8.00. If the dividends tax rate is 40%, then the tax on a \$10 special dividend is \$4.00, and the after-tax income is \$6.00. The difference in after-tax income is \$2.00.

Evaluate: There is no difference in after-tax income when the tax rates on capital gains and dividends are the same. There is a \$2.00 difference in after-tax income if the capital gains tax rate is 20% and the dividend tax rate is 40%.

- 11.**
- a. 1985: Yes, dividends were taxed at 50% relative to 20% for capital gains.
 - b. 1989: No, dividends were not tax-disadvantaged (they were not advantaged either): Dividends and capital gains were both taxed at 28%.
 - c. 1995: Yes, dividends were taxed at 40% relative to 28% for capital gains.
 - d. 1999: Yes, dividends were taxed at 40% relative to 20% for capital gains.
 - e. 2005: No, dividends were not tax-disadvantaged (they were not advantaged either): Dividends and capital gains were both taxed at 15%.
- 12.**
- a. Invest the \$5 special dividend, and earn interest of \$0.50 per year.
 - b. Borrow \$5 today, and use the increase in the regular dividend to pay the interest of \$0.50 per year on the loan.

- 13. Plan:** Determine the values of Kay stock at various times regarding the decision to pay or not pay a one-time dividend.

Execute:

- The value of Kay will remain the same.
- The value of Kay will fall by \$100 million.
- It will neither benefit nor hurt investors.

Evaluate: If the board went ahead with this plan, what would happen to the value of Kay stock upon the announcement of a change in policy? The value of Kay will remain the same.

What would happen to the value of Kay stock on the ex-dividend date of the one-time dividend? The value of Kay will fall by \$100 million.

Given these price reactions, will this decision benefit investors? It will neither benefit nor hurt investors.

- 14. Plan:** Recalculate Problem 10 assuming a 35% corporate tax rate.

Execute:

- The value of Kay will rise by \$35 million.
- The value of Kay will fall by \$100 million.
- It will benefit investors.

Evaluate: If the board went ahead with this plan, what would happen to the value of Kay stock upon the announcement of a change in policy? What would happen to the value of Kay stock on the ex-dividend date of the one-time dividend? The value of Kay will rise by \$35 million.

The value of Kay will fall by \$100 million.

Given these price reactions, will this decision benefit investors? It will benefit investors.

- 15. Plan:** Recalculate Problem 10 assuming investors pay a 15% tax on dividends but no capital gains tax. Kay does not pay corporate taxes.

Execute: Assume investors pay a 15% tax on dividends but no capital gains taxes nor taxes on interest income, and Kay does not pay corporate taxes:

- The value of Kay will remain the same.
- The value of Kay will fall by \$85 million.
- It will neither benefit nor hurt investors.

Evaluate: If the board went ahead with this plan, what would happen to the value of Kay stock upon the announcement of a change in policy? What would happen to the value of Kay stock on the ex-dividend date of the one-time dividend? The value of Kay will remain the same.

The value of Kay will fall by \$85 million.

Given these price reactions, will this decision benefit investors? It will neither benefit nor hurt investors.

Use the following information to answer Questions 16 through 20.

AMC Corporation currently has an enterprise value of \$400 million and \$100 million in excess cash. The firm has 10 million shares outstanding and no debt. Suppose AMC uses its excess cash to repurchase shares. After the share repurchase, news will come out that will change AMC's enterprise value to either \$600 million or \$200 million.

- 16. Plan:** Calculate AMC's share price prior to share repurchase.

Execute: Because Enterprise Value = Equity + Debt – Cash, AMC's equity value is:

$$\text{Equity} = \text{EV} + \text{Cash} = \$500 \text{ million}$$

Therefore,

$$\text{Share price} = (\$500 \text{ million}) / (10 \text{ million shares}) = \$50 \text{ per share.}$$

Evaluate: AMC's share price would be \$50.00 before share repurchase.

- 17. Plan:** Calculate the values of AMC's share price assuming AMC's enterprise value goes up and then declines.

Execute: AMC repurchases $\$100 \text{ million} / (\$50 \text{ per share}) = 2 \text{ million shares}$. With 8 million remaining shares outstanding (and no excess cash), its share price if its EV goes up to \$600 million is:

$$\text{Share price} = \$600 / 8 = \$75 \text{ per share}$$

And if EV goes down to \$200 million:

$$\text{Share price} = \$200 / 8 = \$25 \text{ per share}$$

Evaluate: AMC's share price would rise to \$75.00 if enterprise value rose. It would fall to \$25.00 if enterprise value were to fall.

- *18. Plan:** Calculate the values of AMC's share price assuming AMC's enterprise value goes up and declines and AMC waits until after the news comes out to execute the repurchase.

Execute: If EV rises to \$600 million prior to repurchase, given its \$100 million in cash and 10 million shares outstanding, AMC's share price will rise to:

$$\text{Share price} = (600 + 100) / 10 = \$70 \text{ per share}$$

If EV falls to \$200 million:

$$\text{Share price} = (200 + 100) / 10 = \$30 \text{ per share}$$

The share price after the repurchase will also be \$70 or \$30 because the share repurchase itself does not change the stock price.

Evaluate: AMC's share price would rise to \$70.00 if enterprise value rose. It would fall to \$30.00 if enterprise value were to fall.

Note: The differences in the outcomes for Problem 17 versus Problem 18 arise because by holding cash (a risk-free asset), AMC reduces the volatility of its share price.

19. If management expects good news to come out, they would prefer to do the repurchase first, so that the stock price would rise to \$75 rather than \$70. On the other hand, if they expect bad news to come out, they would prefer to do the repurchase after the news comes out, for a stock price of \$30 rather than \$25. (Intuitively, management prefers to do a repurchase if the stock is undervalued—they expect good news to come out—but not when it is overvalued because they expect bad news to come out.)
- *20. Based on Problem 17, we expect managers to do a share repurchase before good news comes out and after any bad news has already come out. Therefore, if investors believe managers are better informed about the firm's future prospects, and that they are timing their share repurchases accordingly, a share repurchase announcement would lead to an increase in the stock price.
21. **Plan:** A 10% stock dividend means one new share for every 10, so FCF will distribute 2,000 new shares.

Execute:

- Before the dividend, FCF's stock price is $\$700,000/20,000 = \35 .
- Because the stock dividend does not bring in or disgorge any money, FCF's total market capitalization does not change—only the shares outstanding change:

$$\$700,000/22,000 = \$31.8182$$

The investor's 1,000 shares becomes 1,100 shares, so the total value of his or her investment before is $1,000(\$35) = \$35,000$ and after is $1,100(\$31.8182) = \$35,000$.

Evaluate: The stock dividend does not leave the investor any better or worse off because he or she received new shares in proportion to how many he or she held before the stock dividend.

22. **Plan:** Calculate the value of Host's shares assuming a 20% stock dividend and a 3:2 stock split.

Execute:

- With a 20% stock dividend, an investor holding 100 shares receives 20 additional shares. However, because the total value of the firm's shares is unchanged, the stock price should fall to:

$$\text{Share price} = \$20 \times 100/120 = \$20/1.20 = \$16.67 \text{ per share}$$

- A 3:2 stock split means for every two shares currently held, the investor receives a third share. This split is therefore equivalent to a 50% stock dividend. The share price will fall to:

$$\text{Share price} = \$20 \times 2/3 = \$20/1.50 = \$13.33 \text{ per share}$$

Evaluate: A 20% stock dividend should produce a stock price of \$16.67, while a 3:2 stock split should produce a share price of \$13.33.

- 23. Plan:** Determine the stock split ratio required to produce a Berkshire Hathaway A share worth \$50.00.

Execute: To bring its stock price down to \$50 per share, Berkshire Hathaway would need a split ratio of:

$$\frac{\$120,000}{\$50} = 2,400 \text{ to } 1$$

Evaluate: A 2,400 to 1 stock split will reduce a Berkshire Hathaway A share to \$50.00.

- 24. Plan:** Calculate the value of an Adaptec share after the stock dividend.

Execute: The value of the dividend paid per Adaptec share was $(0.1646 \text{ shares of Roxio}) \times (\$14.23 \text{ per share of Roxio}) = \2.34 per share . Therefore, ignoring tax effects or other news that might come out, we would expect Adaptec's stock price to fall to $\$10.55 - 2.34 = \8.21 per share once it goes ex-dividend.

Evaluate: Adaptec's shares should sell for \$8.21 once it goes ex-dividend. (*Note:* In fact, Adaptec stock opened on Monday, May 14, 2001—the next trading day—at a price of \$8.45 per share.)

Chapter 18

Financial Modeling and Pro Forma Analysis

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Calculate next year's estimated cost of goods sold.

Execute:

Current sales: \$100,000

Cost of goods sold: \$72,000

COGS percent of sales: 72%

Forecasted sales: \$110,000

Forecasted COGS = $110,000 \times 72\% = 79,200$

Evaluate: Next year's estimated cost of goods sold is 79,200.

2. **Plan:** Calculate the net financing required in the coming year.

Execute:

Beginning stockholder equity = 300,000

Additions to equity = net income \times retention ratio = $50,000 \times (1 - 0.10) = 45,000$

Ending stockholder equity = 345,000

Beginning total liabilities = 120,000

Increase in non debt liabilities = 10,000

Ending total liabilities = 130,000

Ending total liabilities and equity = 475,000

Ending assets = 500,000

Net financing required: 25,000

Evaluate: \$25,000 in net financing will be required.

- 3. Plan:** Calculate the amounts of debt and equity financing that would be needed in Problem 2 to keep the capital structure constant.

Execute:

Beginning debt:	100,000.00
Beginning equity:	300,000.00
Beginning non debt liabilities:	20,000.00
Debt/Equity ratio:	0.33
New assets:	500,000.00
New non debt liabilities:	30,000.00
New debt + equity:	470,000.00
Amount of equity needed to maintain ratio:	352,500
Amount of debt needed to maintain ratio:	117,500
Amount of debt to issue (117,500 – 100,000):	17,500
Amount of equity to issue (352,500 – 345,000):	7500

Evaluate: With equity growing to 345,000 through retained earnings, the firm would need to issue an additional 7500 in new equity and \$17,500 in new debt to raise the needed net \$25,000 and keep the capital structure constant at 33% debt.

Use the following Income Statement and Balance Sheet for Jim's Espresso for Problems 4–7:

Income Statement		Balance Sheet	
Sales	200,000	<u>Assets</u>	
Costs Except Depr.	(100,000)	Cash and Equivalents	15,000
EBITDA	100,000	Accounts Receivable	2,000
Depreciation	(6,000)	Inventories	4,000
EBIT	94,000	Total Current Assets	21,000
Interest Expense (net)	(400)	Property, Plant, and Equipment	10,000
Pretax Income	93,600	Total Assets	31,000
Income Tax	(32,760)	<u>Liabilities and Equity</u>	
Net Income	60,840	Accounts Payable	1,500
		Debt	4,000
		Total Liabilities	5,500
		Stockholders' Equity	25,500
		Total Liabilities and Equity	31,000



- 4. Plan:** Use the percentage of sales method to forecast the financial line items identified in the problem.

Execute:

Forecasted sales = $200,000 \times (1.10) = 220,000$

Forecasted value = current percent of sales \times forecasted sales.

	Current Percent of Sales	Forecasted
a. Costs	50.00%	\$110,000
b. Depreciation	3.00%	\$6,600
c. Net Income	30.42%	\$66,924
d. Cash	7.50%	\$16,500
e. Accounts Receivable	1.00%	\$2,200
f. Inventory	2.00%	\$4,400
g. Property, Plant, and Equipment	5.00%	\$11,000

Evaluate: Each of the financial line items will grow in proportion to forecasted sales.



- 5. Plan:** Use the percentage of sales method to forecast next year's stockholder's equity and accounts payable.

Execute:

- a. For shareholder's equity, we need to know how much will be added to shareholder equity from net income. Additions to shareholder equity = $66,924 \times (1 - 0.90) = 6,692$.

$$\text{New shareholder equity} = 25,500 + 6,692 = 32,192$$

- b. Current percent of sales: 1.75%. Forecasted accounts payable = $1.75\% \times 220,000 = 1,650$.

Evaluate: Stockholders' equity will grow by \$6,692 (which is the amount of earnings retained in the business) to \$32,192. Accounts payable are forecasted to grow to \$1,650.



6. Plan: Calculate Jim's net new financing for next year.

Execute: Pro forma financial statements for Jim's Espresso:

Income Statement		Balance Sheet	
Sales	220,000	Assets	
Costs Except Depr.	(110,000)	Cash and Equivalents	16,500
EBITDA	110,000	Accounts Receivable	2,200
Depreciation	(6,600)	Inventories	4,400
EBIT	103,400	Total Current Assets	23,100
Interest Expense (net)	(400)	Property, Plant, and Equipment	11,000
Pretax Income	103,000	Total Assets	34,100
Income Tax	(36,076)	Liabilities and Equity	
Net Income	66,924	Accounts Payable	1,650
		Debt	4,000
		Total Liabilities	5,650
		Stockholders' Equity	32,192
		Total Liabilities and Equity	37,842

Total new financing required = Total assets – total liabilities and equity = –3,742.

Evaluate: Jim has excess financing, which means it can use the excess financing to repay debt or pay a dividend to shareholders.

- 7. Plan:** By reducing its payout ratio, it will increase retained earnings, which are added to stockholders' equity. That additional stockholders' equity will reduce the required new financing.

Execute:

For stockholders' equity, we need to know how much will be added to stockholder equity from net income. Additions to stockholder equity = $66,924 \times (1 - 0.70) = 20,077$. Compared to the 90% payout ratio, these additions are $20,077 - 6,692 = 13,385$ more, so net new financing required will be \$13,385 less.

Evaluate:

By reducing its payout ratio, Jim's will not need to secure as much external financing to fund its growth.

Problems 8 through 11 are answered together.

Plan: To use the percent of sales method, first calculate each relevant income statement and balance sheet entry's percent of this year's sales. Then forecast next year's sales as 8% higher than this year's. Finally, create a forecasted income statement and balance sheet by applying the percent of sales calculated in the first step. To complete the balance sheet, we need to know how much of forecast net income will be retained and added to stockholders' equity and how much will be paid out. Problem 9 states that it will be 50%.

Execute:

	This Year	% of Sales	Next Year	
Net Sales	186.7	100%	201.6	$= 186.7 \times (1.08)$
Costs Except Depreciation	-175.1	93.8%	-189.1	$= 0.938 \times 201.6$
EBITDA	11.6	NM	12.5	
Depreciation and Amortization	-1.2	0.6%	-1.3	$= -(0.006 \times 201.6)$
EBIT	10.4	NM	11.2	
Interest Income (expense)	-7.7	NM	-7.7	stays the same
Pretax Income	2.7	NM	3.5	
Taxes (26%)	-0.7	NM	-0.9	
Net Income	2.0	NM	2.6	

	This Year	% of Sales	Next Year	
<u>Assets</u>				
Cash	23.2	12.4%	25.1	$= 0.124 \times 201.6$
Accounts Receivable	18.5	9.9%	20.0	$= 0.099 \times 201.6$
Inventories	15.3	8.2%	16.5	$= 0.082 \times 201.6$
Total Current Assets	57		61.6	
Net Property, Plant, and Equipment	113.1	60.6%	122.1	$= 0.606 \times 201.6$
Total Assets	170.1		183.7	

Liabilities and Equity

Accounts Payable	34.7	18.6%	37.5	$= 0.186 \times 201.6$
Long-Term Debt	113.2		122.7	$= 183.7 - 37.5 - 23.5$
Total Liabilities	147.9		160.2	
Total Stockholders' Equity	22.2		23.5	$= 22.2 + 0.5 \times 2.6$
Total Liabilities and Equity	170.1		183.7	

Note that due to rounding, totals do not appear to always sum.



8. So, the answers are as follows:

- a. Costs: 189.1
- b. Depreciation: 1.3
- c. Net Income: 2.6
- d. Cash: 25.1
- e. Accounts Receivable: 20
- g. Inventory: 16.5
- h. PPE: 122.2
- i. Accounts Payable: 37.5



9. Retained Earnings = Net Income – Payout = $2.2 - 0.5(2.2) = 1.1$

Stockholders' Equity = Previous SE + Retained Earnings = $22.2 + 1.1 = 23.3$



10. In order to make the balance sheet balance, Global's total liabilities and equity must equal its total assets. Its total assets are projected to be 183.7. Its projected accounts payable is 37.5 and its projected stockholders' equity is 23.5. The remainder must be in the form of long-term debt (unless it chooses to issue new equity instead, which would change its projected stockholders' equity).

Forecasted long-term debt = $183.7 - 37.5 - 23.3 = 122.9$

Previous long-term debt is 113.2, so it needs $122.9 - 113.2 = 9.7$ in new financing.

11. If Global limits itself to only \$9 million in new financing, then it must cut its pay out to shareholders by 0.5 in order to make up the difference on its balance sheet. That is, in order to finance the growth in its assets, it will need more than \$9 million in new financing and so will have to retain and reinvest more of its net income.

Evaluate: By creating a pro forma income statement and balance sheet, Global is able to identify how much new financing it will need and what trade-offs with payouts to shareholders exist.




12. **Plan:** Compute production volumes under the revised growth assumptions.

Execute:

	2013	2014	2015	2016	2017	2018
Production Volume (000 units)						
Market Size	10,000	10,500	11,025	11,576	12,155	12,763
Market Share	10.00%	10.25%	10.50%	10.75%	11.00%	11.25%
Production Volume	1,000	1,076	1,158	1,244	1,337	1,436

Evaluate: In 2015, production will exceed 11,000 units, and production capacity will have to be increased.

-  **13. Plan:** Calculate financing needs, interest payments, and interest tax shields as KMS grows.

Execute:

	2013	2014	2015	2016	2017	2018
Debt and Interest Table (\$000s)						
Outstanding Debt	4,500	4,500	4,500	24,500	24,500	24,500
New Net Borrowing			20,000			
Interest on Debt	306	306	306	1,666	1,666	1,666
Interest Tax Shield	107	107	107	583	583	583

Evaluate: The increase in production capacity in 2015 will require KMS to issue \$20,000 in new debt financing. This will increase the amount of annual interest KMS must pay and the amount of the interest tax shield.

-  **14. Plan:** Reproduce Table 18.8 under the new assumptions.

Execute:

	2013	2014	2015	2016	2017	2018
Income Statement (\$000s)						
1 Sales	74,890	82,344	90,341	99,056	108,555	118,916
2 Cost of Goods Sold	(58,414)	(64,228)	(70,466)	(77,264)	(84,673)	(92,755)
3 EBITDA	16,476	18,116	19,875	21,792	23,882	26,162
4 Depreciation	(5,492)	(5,443)	(7,398)	(7,459)	(7,513)	(7,561)
5 EBIT	10,984	12,673	12,477	14,333	16,369	18,601
6 Interest Expense	(306)	(306)	(306)	(1,666)	(1,666)	(1,666)
7 Pretax Income	10,678	12,367	12,171	12,667	17,703	16,935
8 Taxes	(3,737)	(4,328)	(4,260)	(4,434)	(5,146)	(5,927)
9 Net Income	6,941	8,038	7,911	8,234	9,557	11,007

Evaluate: Note that net income is forecasted to decline from 2014 to 2015 as the new production capacity, with its related increase in depreciation expense, come on line.


15. Plan: Calculate KHS's working capital requirements through 2018.

Execute:

	2013	2014	2015	2016	2017	2018
Working Capital (\$000s)						
Assets						
1 Accounts Receivable	14,229	15,645	17,165	18,821	20,625	22,594
2 Inventory	14,978	16,469	18,068	19,811	21,711	23,783
3 Cash	11,982	13,175	14,455	15,849	17,369	19,027
4 Total Current Assets	41,190	45,289	49,688	54,481	59,705	65,404
	2013	2014	2015	2016	2017	2018
Liabilities						
5 Accounts Payable	11,982	13,175	14,455	15,849	17,369	19,027
6 Total Current Liabilities	11,982	13,175	14,455	15,849	17,369	19,027
Net Working Capital						
7 Net Working Capital	29,207	32,114	35,233	38,632	42,336	46,377
8 Increase in Net Working Capital		2,907	3,119	3,399	3,705	4,041

Evaluate: Net working capital is forecasted to grow continually through 2018.

16. Plan: Use Eq. 18.4 to calculate the internal growth rate and Eq. 18.5 to calculate the sustainable growth rate.

Execute:

$$\text{Internal growth rate} = \frac{\text{Net Income}}{\text{Beginning Assets}} \times (1 - \text{Payout Ratio}) = \left(\frac{50,000}{400,000} \right) (1 - 0) = 0.125$$

$$\text{Sustainable growth rate} = \frac{\text{Net Income}}{\text{Beginning Equity}} \times (1 - \text{Payout Ratio}) = \left(\frac{50,000}{250,000} \right) (1 - 0) = 0.20$$

Sustainable growth rate if it pays out 40% of its net income as a dividend:

$$\frac{\text{Net Income}}{\text{Beginning Equity}} \times (1 - \text{Payout Ratio}) = \left(\frac{50,000}{250,000} \right) (1 - 0.4) = 0.12$$

- 17. Plan:** Does KMS's expansion plan call for it to grow slower or faster than its sustainable growth rate?

Execute:

	2013	2014	2015	2016	2017	2018
Income Statement (\$000s)						
1 Sales	74,889	88,369	103,247	119,793	138,167	158,546
2 Cost of Goods Sold	(58,413)	(68,928)	(80,533)	(93,439)	(107,770)	(123,666)
3 EBITDA	16,476	19,441	22,714	26,354	30,397	34,880
4 Depreciation	(5,492)	(7,443)	(7,498)	(7,549)	(7,594)	(7,634)
5 EBIT	10,984	11,998	15,216	18,805	22,803	27,246
6 Interest Expense	(306)	(306)	(1,666)	(1,666)	(1,666)	(1,666)
7 Pretax Income	10,678	11,692	13,550	17,139	21,137	25,580
8 Taxes	(3,737)	(4,092)	(4,743)	(5,999)	(7,398)	(8,953)
9 Net Income	6,940	7,600	8,808	11,141	13,739	16,627
	2013	2014	2015	2016	2017	2018
Payout ratio:	30%					
Additions to shareholder equity:	4,858	5,320	6,165	7,798	9,617	11,639
Beginning shareholder equity:		74,134	79,454	85,619	93,418	103,035
Sustainable growth rate:		7.18%	7.76%	9.11%	10.29%	11.30%
Actual growth rate:		18.00%	16.84%	16.03%	15.34%	14.75%

Evaluate: KMS's expansion calls for it to grow faster than its sustainable growth rate.

18. Plan: Calculate the additional debt that will have to be issued to support growth.

Execute:

$$\begin{aligned}\text{Sustainable Growth Rate} &= ROE \times (1 - \text{Payout Ratio}) \\ &= 12\% \times (1 - 25\%) \\ &= 9\%\end{aligned}$$

Beginning Total Assets = \$1 million

Ending total assets at a growth rate of 9%: \$1.09 million.

Evaluate: Because the firm grew at its sustainable growth rate, its debt/equity ratio remains constant at 0.667, and the debt to assets ratio will be 0.40. Thus, the new debt in the capital structure will be 0.4×1.09 million = \$436,000. Because the firm started at \$400,000, it will issue \$36,000 in additional debt.

19. Plan: First calculate its internal growth rate and then calculate the new debt and equity.

Execute:

Its payout ratio is $5,000/20,000 = 0.25$

$$\frac{\text{Net Income}}{\text{Beginning Assets}} \times (1 - \text{Payout Ratio}) = \left(\frac{20,000}{400,000} \right) (1 - 0.25) = 0.0375$$

If its assets grow at its internal growth rate, they grow to $400,000(1.0375) = 415,000$. All of the 15,000 in additional assets is financed by retained earnings of \$15,000 (= 20,000 – 5,000 dividend). That means the new equity is 315,000 and the debt that remains is 100,000, for a D/E ratio of $100,000/315,000 = 0.3175$.

Evaluate: If it grows at its internal growth rate, its leverage will decrease as it adds assets and equity without increasing its debt.



20. Plan: Calculate KMS's free cash flow through 2018.

Execute:

	2013	2014	2015	2016	2017	2018
Free Cash Flow (\$000s)						
1 Net Income	6,941	8,038	7,911	8,234	9,557	11,007
2 Plus: After-Tax Interest Expense	199	199	199	1,083	1,083	1,083
3 Unlevered Net Income	7,139	8,237	8,110	9,317	10,640	12,090
4 Plus: Depreciation	5,492	5,443	7,398	7,459	7,513	7,561
5 Less: Increases in NWC	0	(2,907)	(3,119)	(3,399)	(3,705)	(4,041)
6 Less: Capital Expenditures	(5,000)	(5,000)	(28,000)	(8,000)	(8,000)	(8,000)
7 Free Cash Flow of Firm	7,631	5,773	(15,611)	5,377	6,448	7,611


Evaluate: KMS should generate positive free cash flow in each year except 2012. 2012 is the year that KMS must expand production capacity and that will require a large increase in capital expenditures.

-  **21. Plan:** Value KMS assuming an EBITDA multiple of 8.5.

Execute:

$$\begin{aligned}\text{EBITDA}_{2015} &= 26,162 \\ \text{Continuation Value}_{2015} &= 26,162 \times 8.5 \\ &= 222,373\end{aligned}$$

Evaluate: Based on an EBITDA multiple of 8.5, KMS would have a continuation value of \$222,373.

-  **22. Plan:** Compute the value of KMS under the 0.25% growth assumption and a cost of capital of 10%.

Execute:

	2013	2014	2015	2016	2017	2018
Free Cash Flow (\$000s)						
Free Cash Flow of Firm	7,631	5,773	(15,611)	5,377	6,448	7,611
Continuation Value						222,373

$$\text{NPV} = \frac{7,631}{1.10} + \frac{5,773}{(1.10)^2} + \frac{-15,611}{(1.10)^3} + \frac{5,377}{(1.10)^4} + \frac{6,448}{(1.10)^5} + \frac{7,611 + 222,373}{(1.10)^6}$$

$$\text{NPV} = 151,224$$

Evaluate: The value of KMS in 2013 is \$151,224.

Chapter 19

Working Capital Management

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Calculate Homer Boats operating cycle.

Execute: Operating Cycle = inventory days + receivable days = 65 + 32 = 97 days.

Evaluate: Homer Boats turns over (i.e., sells) its inventory in 65 days and collects the cash from the sale in 32 days. So, it takes Homer Boats 97 days to sell a boat and collect the cash from the sale.

2. **Plan:** Calculate the cash conversion cycle for FastChips.

Execute: Cash Conversion Cycle = inventory days + receivable days – payables days = 83 + 45 – 75 = 53 days

Evaluate: FastChips turns over (i.e., sells) its inventory in 83 days and collects the cash from the sale in 45 days. So, it takes Homer Boats 128 days to sell a computer chip and collect the cash from the sale. But FastChip has to pay its own supplier in 75 days for the computer chip. Hence at day 75, FastChip has to come up with the cash to pay its supplier for the computer chip and then wait 53 additional days (to day 128) before its customer pays it for the computer chip.

3. **Plan:** Calculate the components (Inventory days, Receivable days, and Payable days) of the Cash Conversion Cycle, and then calculate the cash conversion cycle.

Execute:

$$\begin{aligned}\text{Inventory days} &= \frac{\text{Inventory balance}}{\text{Cost of goods sold}/365} \\ &= \frac{15,000}{80,000/365} \\ &= 68.44 \text{ days}\end{aligned}$$

$$\begin{aligned}
 \text{Receivable days} &= \frac{\text{Accounts receivable balance}}{\text{Sales}/365} \\
 &= \frac{30,000}{100,000/365} \\
 &= 109.5 \text{ days}
 \end{aligned}$$

$$\begin{aligned}
 \text{Payable days} &= \frac{\text{Accounts payable balance}}{\text{Cost of goods sold}/365} \\
 &= \frac{40}{80,000/365} \\
 &= 182.5 \text{ days}
 \end{aligned}$$

Evaluate: Cash Conversion Cycle = inventory days + receivable days – payables days = 68.44 + 109.5 – 182.5 = –4.56 days

Westerly collects cash from its customers 4.56 days before it has to pay its suppliers.

4. **Plan:** Aberdeen Outboard Motors will have to invest \$3,500,000 in net working capital today and not recover that \$3,500,000 investment for 15 years. Calculate the NPV of the investment.

Execute: Ignoring revenues and other expenses associated with the new plant, the NPV of the \$3.5 million investment in net working capital is simply the present value of the \$3.5 million that the firm will recoup at the end of 15 years minus the initial \$3.5 million investment.

$$\begin{aligned}
 \text{NPV} &= -\$3,500,000 + \frac{\$3,500,000}{(1.08)^{15}} \\
 &= -\$2,396,654
 \end{aligned}$$

Evaluate: The investment in net working capital will cost Aberdeen \$2,396,654 in today's dollars.

5. **Plan:** Calculate the Present Value of the working capital investment under a 8% and a 6% growth rate assumption. Then compute the difference in Present Value.

Execute: The cost of the working capital is the present value of the future changes in the working capital from year to year.

The PV of the cost of the working capital growing at 8% is:

$$\begin{aligned}
 \text{PV} &= \frac{250,000(1.08)}{0.15 - 0.08} - \frac{250,000(1.08)}{(0.15 - 0.08) \times 1.15} \\
 &= 503,106
 \end{aligned}$$

The PV of the cost of working capital growing at 6% is:

$$\text{PV} = \frac{250,000(1.06)}{0.15 - 0.06} - \frac{250,000(1.06)}{(0.15 - 0.06) \times 1.15}$$

$$= 384,058$$

Evaluate: The change from 8% to 6% growth in working capital reduces the present value of the cost of investing in the working capital from \$503,106 to \$384,058, resulting in an increase in firm value of \$119,048.

6. **Plan:** The problem provides much financial data about the Greek Connection and requires several calculations about its net working capital and cash conversion cycle.

Execute:

- a. Net working capital is current assets minus current liabilities. Using this definition, the Greek Connection's net working capital is $\$7,250 - \$3,720 = \$3,530$. Some analysts calculate the net operating working capital instead, which is the noninterest-earning current assets minus the noninterest bearing current liabilities. In this case, the notes payable would not be included in the calculation because they are assumed to be interest bearing. Net operating working capital for the Greek Connection is $\$7,250 - (\$1,500 + \$1,220) = \$4,530$.
- b. The cash conversion cycle (CCC) is equal to the inventory days plus the accounts receivable days minus the accounts payable days. The Greek Connection's cash conversion cycle for 2010 was 41.4 days.

$$\begin{aligned} \text{CCC} &= \frac{\text{Inventory}}{\text{Average daily COGS}} + \frac{\text{Accounts receivable}}{\text{Average daily sales}} - \frac{\text{Accounts payable}}{\text{Average daily COGS}} \\ \text{CCC}_{2010} &= \frac{\frac{\$1,300}{365}}{\frac{\$20,000}{365}} + \frac{\frac{\$3,950}{365}}{\frac{\$32,000}{365}} - \frac{\frac{\$1,500}{365}}{\frac{\$20,000}{365}} \\ &= 23.7 \text{ days} + 45.1 \text{ days} - 27.4 \text{ days} \\ &= 41.4 \text{ days.} \end{aligned}$$

- c. If the Greek Connection accounts receivable days had been 30 days, its cash conversion cycle would have been only 26.3 days:

$$\begin{aligned} \text{CCC} &= 23.7 \text{ days} + 30 \text{ days} - 27.4 \text{ days} \\ &= 26.3 \text{ days} \end{aligned}$$

Evaluate: The data shows that the Greek Connection collects its account receivable in 45.1 days, while the industry average receivables collection is 30 days. This means that the Greek Connection has a significantly longer cash collection cycle than its competitors.

7. **Plan:** Calculate the cost of the trade credit if your firm does not take the discount and pays on day 60.

Execute: In this instance, the customer will have the use of \$98 for an additional 50 days (60 – 10) if he chooses not to take the discount. It will cost him \$2 to do so since he must pay \$100 for the goods if he pays after the 10-day discount period. Thus, the interest rate per period is:

$$\begin{aligned} \frac{\$2}{\$98} &= 0.0204 \\ &= 2.04\% \end{aligned}$$

The number of 50-day periods in a year is $365/50 = 7.3$ periods. So, the effective annual cost of the trade credit is:

$$\begin{aligned}\text{EAR} &= (1.0204)^{7.3} - 1 \\ &= 15.88\%\end{aligned}$$

Evaluate: As we have calculated, the annual cost of not taking the trade discount is 15.88%. If the firm has other means of financing such as a bank line of credit at 10% annually, it should take the trade discount, avoid the 15.88% cost, and borrow from the bank.

8. Plan: Calculate the cost of not taking the trade discount.

Execute: If you were to pay within the 10-day discount period, you would pay \$96 for \$100 worth of goods. If you wait until day 60, you will owe \$100. Thus, you are paying \$4 in interest for a 50-day (60 – 10) loan. The interest rate per period is:

$$\begin{aligned}\frac{\$4}{\$96} &= 0.0417 \\ &= 4.17\%\end{aligned}$$

The number of 50-day periods in a year is $365/50 = 7.3$ periods. So, the effective annual cost of the trade credit is:

$$\begin{aligned}\text{EAR} &= (1.0417)^{7.3} - 1 \\ &= 34.75\%\end{aligned}$$

Evaluate: As in previous Problem 19.7, the firm should look to its other sources of financing instead of paying such a high interest rate of 34.75%.

***9. Plan:** Calculate the costs and benefits of outsourcing the billing and collection functions. Outsource if benefits outweigh costs.

Execute: The benefit of outsourcing the billing and collection to the other firm is equal to what Fast Reader can earn on the funds that are freed up. Because average daily collections are \$1,200 and float will be reduced by 20 days, Fast Reader will have an additional \$24,000 ($\$1,200 \times 20$). (Think about this as follows. Immediately after hiring the billing firm, its collection float drops by 20 days, so all collections due within the next 20 days are immediately available.) The billing firm charges \$250 per month. At an 8% annual rate, the monthly discount rate is $1.081/12 - 1 = 6.43\%$, so the present value of these charges in perpetuity is $250/0.0643 = \$38,856$.

Evaluate: Thus, the costs (\$38,856) exceed the benefits (\$24,000), and Fast Reader should not employ the billing firm.

***10. Plan:** Calculate the costs and benefits of switching banks. Shift to the new bank if benefits outweigh costs.

Execute: The electronic funds transfer system will free up \$128,000 ($= 8 \times \$16,000$). (Think about this as follows. Immediately after switching banks its collections due within the next 8 days are immediately available.) On the other hand, Saban will have to pay a cost because it has

to hold \$80,000 in a non interest earning account, which means it has essentially given up these funds.

Evaluate: Because the benefits (\$128,000) are larger than the costs (\$80,000) it should switch banks.

11. Plan: Calculate accounts receivables collection in days.

Execute: If we assume all the sales were made on credit, the average length of time it takes Manana to collect on its sales is 12.2 days:

$$\begin{aligned}\text{Accounts receivable days} &= \frac{\text{Accounts receivable}}{\text{Average daily sales}} \\ &= \frac{\$25\text{m}}{\frac{\$280\text{m}}{365}} \\ &= 32.59 \text{ days}\end{aligned}$$

Evaluate: It takes Manana Manana 32.59 days on average to collect its accounts receivable.



12. Plan: Compute an aging schedule for accounts receivable.

Execute: Mighty Power Tool Company Aging Schedule

Days Outstanding	Amount Owed	Percent of Accounts Receivable
0–15	\$ 68,000	19.3%
16–30	\$ 75,000	21.2%
31–45	\$ 92,000	26.1%
46–60	\$ 82,000	23.2%
more than 60	\$ 36,000	10.2%
	\$353,000	100.0%

Evaluate: \$36,000 of accounts receivable are more than 60 days outstanding. If credit terms are net 30 days, management should investigate.

13. Plan: Calculate the benefit of taking the discount. If it is more than the 10% cost of the loan then borrow from the bank and take the discount.

Execute: If Simple Simon's takes the discount, it must pay \$99 in 5 days for every \$100 of purchases. If it elects not to take the discount, it will owe the full \$100 in 30 days. The interest rate on the loan is:

$$\begin{aligned}\frac{\$1}{\$99} &= 0.0101 \\ &= 1.01\%\end{aligned}$$

The loan period is 20 days ($= 30 - 10$). The effective annual cost of the trade credit is:

$$\begin{aligned}\text{EAR} &= (1.0101)^{365/20} - 1 \\ &= 20.1\%\end{aligned}$$

Evaluate: Since the bank loan is only 10%, Simple Simon should borrow the funds from the bank in order to take advantage of the discount.

- 14. Plan:** Calculate the effective annual cost of not taking the discount and paying in full in 40 versus 50 days.

Execute:

- a. Your firm is paying \$3 to borrow \$97 for 25 days ($= 40 - 15$). The interest rate per period is:

$$\begin{aligned}\frac{\$3}{\$97} &= 0.0309 \\ &= 3.09\%\end{aligned}$$

The effective annual rate is:

$$(1.0309)^{365/25} - 1 = 55.9\%$$

- b. In this case, your firm is stretching its accounts payable. You are still paying \$3 to borrow \$97, so the interest rate per period is 3.09%. However, the loan period is now 35 days ($= 50 - 15$). The effective annual rate is reduced to 37.4% because your firm has use of the money for a longer period of time:

$$\begin{aligned}\text{EAR} &= (1.0309)^{365/35} - 1 \\ &= 37.4\%\end{aligned}$$

Evaluate: The annual effective cost of not taking the discount and paying in full in 40 days is 55.9%. This falls to 37.4% if the firm can delay making the payment for 50 days.



- *15. Plan:** Calculate the firm's cash conversion cycle over two different years. Evaluate how well the firm is managing its payables.

Evaluate:

- a. The cash conversion cycle (CCC) is equal to the inventory days plus the accounts receivable days minus the accounts payable days. IMC's cash conversion cycle for 2012 was 35.2 days, and for 2013, it was 45.6 days.

$$\begin{aligned}\text{CCC} &= \frac{\text{Inventory}}{\text{Average daily COGS}} + \frac{\text{Accounts receivable}}{\text{Average daily sales}} - \frac{\text{Accounts payable}}{\text{Average daily COGS}} \\ \text{CCC}_{2012} &= \frac{\$6,200}{\frac{\$52,000}{365}} + \frac{\$2,800}{\frac{\$60,000}{365}} - \frac{\$3,600}{\frac{\$52,000}{365}} \\ &= 43.5 \text{ days} + 17.0 \text{ days} - 25.3 \text{ days} \\ &= 35.2 \text{ days}\end{aligned}$$

$$\begin{aligned}
 CCC_{2013} &= \frac{\$6,600}{\frac{\$61,000}{365}} + \frac{\$6,900}{\frac{\$75,000}{365}} - \frac{\$4,600}{\frac{\$61,000}{365}} \\
 &= 39.5 \text{ days} + 33.6 \text{ days} - 27.5 \text{ days} \\
 &= 45.6 \text{ days}
 \end{aligned}$$

IMC's cash conversion cycle has lengthened in 2013, due to an increase in its accounts receivable days. The number of days goods are held in inventory has decreased, and IMC is taking longer to pay its suppliers, both of which would decrease the cash conversion cycle, all else being equal. These changes were not enough to offset the increase in the amount of time it is taking IMC's customers to pay for purchases made on credit. The lengthening of the cash conversion cycle means that IMC will require more cash.

Execute:

- b. If IMC's suppliers are offering terms of net 30 days, IMC should consider waiting longer to pay for its purchases. In 2012, it paid nearly five days earlier than necessary, and in 2013, it paid 2.5 days earlier. IMC could, therefore, have kept the money working for it longer because there was no discount offered for early payment. The early payment may give IMC a preferred position with its suppliers, however, which may have benefits that are not presented here. IMC's decision on whether to extend its accounts payable days would have to take these benefits into consideration.

- 16. Plan:** Calculate the average days of inventory.

Execute:

$$\begin{aligned}
 \text{Average days of inventory} &= \frac{\text{Average inventory balance}}{\text{Cost of goods sold}/365} \\
 &= \frac{\$1,680,000}{\frac{\$8,000,000}{365}} \\
 &= 76.65 \text{ days}
 \end{aligned}$$

Evaluate: Items stay in inventory for 76.65 days.

- 17. Plan:** Calculate inventory in days. Also evaluate how much the firm would have to reduce its inventory to get its inventory days to match the industry average.

Execute:

- a. The inventory days ratio is equal to the inventory divided by average daily cost of goods sold. This was 91.25 days for Happy Valley Homecare Suppliers in 2010:

$$\begin{aligned}
 \text{Inventory days} &= \frac{\$2,000,000}{\frac{\$8,000,000}{365}} \\
 &= 91.25 \text{ days}
 \end{aligned}$$

Evaluate:

- b. To reduce its inventory days to 73 days, HVHS must decrease its investment in inventory turnover to \$1,600,000:

$$73 \text{ days} = \frac{\text{Inventory}}{\frac{\$8,000,000}{365}} \Rightarrow \text{Inventory} = \$1,600,000$$

This means HVHS could reduce its investment in inventory by \$400,000 (= \$2,000,000 – \$1,600,000).

Chapter 20

Short-Term Financial Planning

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.



1. a. **Plan:** Calculate the firm's working capital needs for each month, and select the month with the highest working capital need.

Execute: To determine Sailboats seasonal working capital needs, we calculate the changes in net working capital for the firm:

Changes in Working Capital	Month					
	1	2	3	4	5	6
Accounts Receivable	\$1	\$1	\$1	\$2	\$3	-\$4
Inventory	-\$1	\$2	\$1	0	-\$1	-\$2
Accounts Payable	0	0	0	0	0	0
Change in Net Working Capital	\$0	\$3	\$2	\$2	\$2	-\$6

Evaluate: From the table it can be seen that Sailboat's working capital needs are highest in Month 2 because its investments in accounts receivable and in inventory increased the most in that month.

- b. **Plan:** Calculate the surplus cash position by month, and identify those months when surplus cash is positive.

Execute:

(\$000)	Month					
	1	2	3	4	5	6
Net Income	10	\$12	\$15	\$25	\$30	\$18
plus depreciation	2	3	3	4	5	4
minus changes in net working capital	0	3	2	2	2	-6
Cash Flow from operations	12	\$12	\$16	\$27	\$33	\$28
minus capital expenditures	1	0	0	1	0	0
Change in Cash	11	\$12	\$16	\$26	\$33	\$28

Evaluate: Sailboats, and so forth, has a surplus cash position in every month as shown above.



2. a. **Plan:** Calculate the working capital levels and changes over four quarters.

Execute:

	Current	Q1	Q2	Q3	Q4
Accounts Receivable	\$ 0	\$ 4,000	\$10,000	\$ 2,000	\$10,000
Inventory	\$4,000	\$10,000	\$ 2,000	\$10,000	\$ 0
Accounts Payable	\$2,000	\$ 5,000	\$ 1,000	\$ 5,000	\$ 0
Working Capital	\$2,000	\$ 9,000	\$11,000	\$ 7,000	\$10,000
Changes in Working Capital		\$ 7,000	\$ 2,000	-\$ 4,000	\$ 3,000

Evaluate: Working capital increases in Quarters 1, 2, and 4. Working capital decreases in Quarter 3.

- b. **Plan:** Determine Emerald City's financing needs over the four quarters.

Execute:

	Q1	Q2	Q3	Q4
Net Income	\$4,000	\$10,000	\$ 2,000	\$10,000
Changes in Working Capital	\$7,000	\$ 2,000	-\$ 4,000	\$ 3,000
Financing Needs	\$3,000	\$ 0	\$ 0	\$ 0
Excess Cash	\$ 0	\$ 5,000	\$11,000	\$18,000

Evaluate: Emerald City would need to obtain short-term financing of \$3,000 for the first quarter.



3. **Plan:** Calculate the permanent and temporary working capital needs for four quarters.

Execute: The net working capital for each quarter is calculated below:

(\$000)	Quarter			
	1	2	3	4
Cash	\$100	\$100	\$ 100	\$100
Accounts Receivable	\$200	\$100	\$ 100	\$600
Inventory	\$200	\$500	\$ 900	\$ 50
Accounts Payable	<u>\$100</u>	<u>\$100</u>	<u>\$ 100</u>	<u>\$100</u>
Net Working Capital	\$400	\$600	\$1,000	\$650

Evaluate: The minimum level of net working capital—\$400,000 in Quarter 1—represents the firm's permanent working capital. The difference between the higher net working capital

levels in each quarter and the permanent working capital needs represents the firm's temporary working capital needs. Thus the firm has temporary working capital needs of \$200,000 in Quarter 2, \$600,000 in Quarter 3, and \$250,000 in Quarter 4.



- 4. Plan:** Calculate the excess cash levels over four quarters.

Execute:

	Q1	Q2	Q3	Q4
Net Working Capital	400	600	1,000	650
Amount of Borrowing	1,000			
Excess Cash	600	400	0	350

Evaluate: You would need \$1,000,000 to finance the total working capital needs of the firm. You will have excess cash in Quarters 1, 2, and 4.



- 5. Plan:** Calculate the short-term borrowing needs over four quarters.

Execute:

Temporary Working Capital	0	200	600	250
Short-Term Financing Needs	0	200	600	250

Evaluate: The short-term financing is equal to the temporary working capital, which is the highest in Q3 at \$600,000.



- 6. Plan:** Determine the maximum amount of short-term borrowing needed if the firm enters the year with \$400 in cash.

Execute:

	Q1	Q2	Q3	Q4
Cash at Beginning of Quarter	400	400	200	100
Minimum Cash Balance	100	100	100	100
Temporary Working Capital Needs	0	200	600	250
Short-Term Borrowing	0	0	500	250
Ending Cash Balance	400	200	100	100

Evaluate: The maximum short-term borrowing occurs in Q3 and is \$500,000.



- 7. Plan:** Calculate how much cash the firm must carry to limit short-term borrowing to \$500.

Execute:

	Q1	Q2	Q3	Q4
Cash at Beginning of Quarter	400	400	200	100
Minimum Cash Balance	100	100	100	100
Temporary Working Capital Needs	0	200	600	250
Short-Term Borrowing	0	0	500	250
Ending Cash Balance	400	200	100	100

Evaluate: The excess cash needed is \$300,000 (\$400,000 starting cash balance minus \$100,000 minimum cash balance).

- 8. Plan:** Calculate the interest rate that is being charged on each of the three borrowing alternatives, and select the borrowing alternative with the lowest interest rate.

Execute:

Alternative A: The effective annual cost of the trade credit is 44.6%, calculated as follows:

$$\text{Interest rate per period} = \frac{\$2}{\$98} = 2.041\%$$

The loan period is 20(= 30 – 10) periods and there are 18.25 periods in a year (365/20 = 18.25).

$$\text{EAR} = (1.02041)^{18.25} - 1 = 44.6\%$$

Alternative B: Hand-to-Mouth will need to borrow \$10,100 just to cover its loan origination fee. Beyond that, it needs to have enough to meet the compensating balance requirement. So, the total amount that Hand-to-Mouth must borrow is \$10,632:

$$\text{Amount needed} = \frac{\$10,100}{1 - 0.05} = \$10,632$$

At a 12% APR, the interest expense for the 30-day loan will be 0.01(\$10,632) = \$106.32.

Because the loan origination fee is simply additional interest, the total interest on the 30-day loan is \$106.32 + \$100 = \$206.32. The firm's usable proceeds from the loan is \$10,000. So, the interest rate per period is:

$$2.063\% \left(= \frac{\$206.32}{\$10,000} \right)$$

The effective annual rate of Alternative B is $(1.02063)^{365/30} - 1 = 28.2\%$.

Alternative C: Hand-to-Mouth will need to borrow \$10,100 in order to cover the loan origination fee. An APR of 15% translates to an interest rate of

$$1.25\% \left(= \frac{15\%}{12} \right)$$

for 30 days. The interest expense for one month is $0.0125 \times \$10,100 = \126.25 . This with the loan origination fee makes the total interest charge \$226.25 for the 30-day loan. This amounts to 2.263% for 30 days:

$$\frac{\$226.25}{\$10,000}$$

The effective annual rate is $(1.02263)^{365/30} - 1 = 31.3\%$.

Evaluate: Thus, Alternative B is the cheapest at an effective annual rate of 28.2%.

- 9. Plan:** Calculate the effective annual cost of each loan. Select the loan with the lowest cost.

Execute: The loan with the 1% loan origination fee would cost the most because the loan origination fee is just another form of interest, so on a \$1,000 loan, the borrower is paying \$90 in interest and will have the use of only \$990 for the period, making the effective annual cost of the loan more than 9% ($\$90/\$990 = 9.1\%$). The compensating balance requirement of 5% on a \$1,000 loan reduces the usable proceeds of the firm by 5% to \$950, but the interest rate is still 8%, so the effective annual cost of that arrangement is:

$$8.4\% \left(= \frac{\$80}{\$950} \right)$$

The effective annual rate is not increased by a full percentage.

Evaluate: Take the loan with the compensating balance.

- 10 Plan:** Calculate the annual effective cost of each loan and select the loan with the lowest cost.

Execute: The effective annual rates of each of the alternatives are calculated as follows:

- Because the APR is 6%, the monthly rate is $6\%/12 = 0.5\%$. This translates to an effective annual rate of $(1.005)^{12} - 1 = 6.2\%$.
- The compensating balance is $\$1,000 \times 0.10 = \100 . Therefore, the borrower will have use of only \$900 of the \$1,000. The interest is $0.06 \times \$1,000 = \60 . The interest rate per period is $\$60/\$900 = 6.7\%$. Because this alternative assumes annual compounding, the effective annual rate is 6.7% as well.
- The interest expense is $0.06 \times \$1,000$, and the loan origination fee is $0.01 \times \$1,000 = \10 . The loan origination fee reduces the usable proceeds of the loan to \$990 because it is paid at the beginning of the loan. The interest rate per period is $\$70/\$990 = 7.1\%$. Because the loan is compounded annually in this case, 7.1% is the effective annual rate.

Evaluate: Thus, Alternative A offers the lowest effective annual cost and should be taken.

- 11. Plan:** Calculate the effective annual rate of the loan.

Execute: In this problem, Needy must pay \$400 every three months to have the use of \$10,000. Thus, the interest rate per period is $\$400/\$10,000 = 4\%$. Because there are four three-month periods in a year, the effective annual rate is $(1.04)^4 - 1 \approx 17\%$.

Evaluate: The effective annual rate on this loan is approximately 17%.

- 12. Plan:** Calculate the effective annual rate on this financing.

Execute: Treadwater is paying \$15,000 ($= \$1,000,000 - \$985,000$) to use \$985,000 for three months, so the three-month interest rate is $\$15,000/\$985,000 = 1.523\%$. There are four three-month periods in a year, making the effective annual rate $(1.01523)^4 - 1 = 6.2\%$.

Evaluate: Treadwater is paying an annual effective rate of 6.2%.

- 13. Plan:** Calculate the effective annual rate on this financing.

Execute: Magna is paying \$26,290 ($= \$1,000,000 - \$973,710$) to use \$973,710 for six months. The six-month interest rate is $\$26,290/\$973,710 = 2.7\%$. There are two six-month periods in a year, so the effective annual rate is $(1.027)^2 - 1 = 5.5\%$.

Evaluate: Magna is paying an annual effective rate of 5.5%.

- 14. Plan:** Calculate the dollars in interest that Treadwater and Magna saved by raising funds from commercial paper as opposed to borrowing from a bank at the prime rate of interest.

Execute: For Treadwater:

$$\frac{1,000,000}{1.02} = 980,392$$

For Magna:

$$\frac{1,000,000}{(1.02)^2} = 961,169$$

Evaluate: Treadwater saved \$4,608 ($= 985,000 - 980,392$), and Magna saved \$12,541 ($= 973,710 - 961,169$) by issuing commercial paper as opposed to borrowing at the prime rate.

- 15. Plan:** Calculate the effective annual rate on this financing.

Execute: Signet's interest expense on this loan is \$129,150 ($= \$6,000,000 - \$5,870,850$), and the usable proceeds are \$5,870,850. The interest rate for the four-month period is $\$129,150/\$5,870,850 = 2.2\%$. The effective annual rate is $(1.022)^3 - 1 = 6.7\%$.

Evaluate: Signet is paying an annual effective rate of 6.7%.

- 16. Plan:** Calculate the effective annual rate of this financing.

Execute: The monthly interest rate is $9\%/12 = 0.75\%$, so Ohio Valley Steel must pay $0.0075 \times \$5,000,000 = \$37,500$ in interest on the loan. Combining this with the \$5,000 warehouse fee

makes the monthly cost of the loan \$42,500. Because the fee is paid at the end of the month, Ohio Valley Steel has use of the full \$5,000,000 for the month. The interest rate per period is $\$42,500/\$5,000,000 = 0.85\%$. There are 12 months in a year, so the effective annual rate is $(1.0085)^{12} - 1 = 10.7\%$.

Evaluate: Ohio Valley is paying an annual effective rate of 10.7%.

17. Plan: Calculate the effective annual rate of this financing.

Execute: Rasputin's interest expense is $0.10(\$500,000) = \$50,000$. The warehouse fee is $0.01(\$500,000) = \$5,000$. Because the warehouse fee must be paid at the beginning of the year, Rasputin's usable proceeds from the loan are only \$495,000 ($= \$500,000 - \$5,000$). The effective annual rate is $\$55,000/\$495,000 = 11.1\%$.

Evaluate: Rasputin is paying an annual effective rate of 11.1%.



18. Plan: Construct the short-term financial plan.

Execute:

	2014Q4	2014Q1	2015Q2	2015Q3	2015Q4
Income Statement (\$000)					
1 Sales	4,545	5,000	6,000	6,000	6,000
2 Cost of Goods Sold	(2,955)	(3,250)	(3,900)	(3,900)	(3,900)
3 Selling, General and Administrative	(455)	(1,000)	(600)	(600)	(600)
4 EBITDA	1,136	750	1,500	1,500	1,500
5 Depreciation	(455)	(500)	(525)	(525)	(525)
6 EBIT	682	250	975	975	975
7 Taxes	(239)	(88)	(341)	(341)	(341)
8 Net Income	443	163	634	634	634
Statement of Cash Flows (\$000)					
9 Net Income		163	634	634	634
10 Depreciation		500	525	525	525
11 Changes in Working Capital					
12 Accounts Receivable		(136)	(300)	0	0
13 Inventory		0	0	0	0
14 Account Payable		48	105	0	0
15 Cash from Operating Activities		574	964	1,159	1,159
16 Capital Expenditures		(1,500)	(525)	(525)	(525)
17 Other Investments		0	0	0	0
18 Cash from Investing Activities		(1,500)	(525)	(525)	(525)
19 Net Borrowing		0	0	0	0
20 Dividends		0	0	0	0
21 Capital Contributions		0	0	0	0
22 Cash from Financing Activities		0	0	0	0
23 Change in Cash and Equivalents		(926)	439	634	634

Cash Balance and Short-Term Financing (\$000)

24	Starting Cash Balance	1,000	500	502	1,136
25	Change in Cash and Equivalents	(926)	439	634	634
26	Minimum Cash Balance	500	500	500	501
27	Surplus (Deficit) Relative to Minimum	(426)	439	636	1,269
28	Increase (Decrease) in Short-Term Financing	426	(437)	0	0
29	Existing Short-Term Financing	0	437	0	0
30	Total Short-Term Financing	426	0	0	0
31	Ending Cash Balance	1,000	500	502	1,136
					1,770

Evaluate: They will need to borrow \$426,000 for the first quarter of 2013, and they will pay back the loan during Q2 of 2013. This financial plan will allow them to expand the business and meet minimum capital needs.

Chapter 21

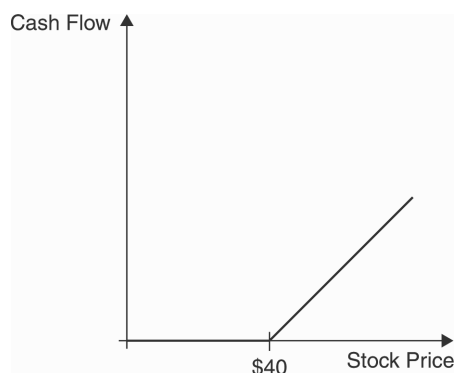
Option Applications and Corporate Finance

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1.
 - a. The contract with the highest volume is: 12 Sep 205.00 Call.
 - b. The contract with the highest open interest is: 12 Oct 205 Call.
 - c. You buy at the ask price, and each contract is for 100 options and is quoted per option, so you will pay $\$8.45 \times 100 = \845 .
 - d. You sell at the bid price, and each contract is for 100 options and is quoted per option, so you will pay $\$0.36 \times 100 = \36 .
 - e. An in-the-money call is one for which the current stock price is greater than the strike price. Because the stock price is 206.36, this is true for strike prices of 200 and 205.
An in-the-money put is one for which the current stock price is less than the strike price. Because the stock price is 206.36, this is true for strike prices of 210 and 215.
2. **Plan:** Value the call if the stock is selling at \$55 and \$35. Draw a payoff diagram showing the value of the call as a function of the stock price at expiration.

Execute: Long call option value at expiration:

- a. \$15
- b. \$0
- c. Draw graph:

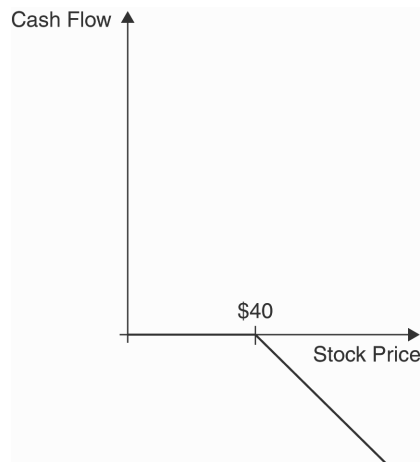


Evaluate: At a stock price of \$55, the call option would be worth \$15. At a stock price of \$35, the call option would be worth 0.

3. **Plan:** Value a short of the call if the stock is selling at \$55 and \$35. Draw a payoff diagram showing the value of the short of the call as a function of the stock price at expiration.

Execute: Short call value at expiration date:

- You owe \$15.
- You owe nothing.
- Draw the payoff diagram:

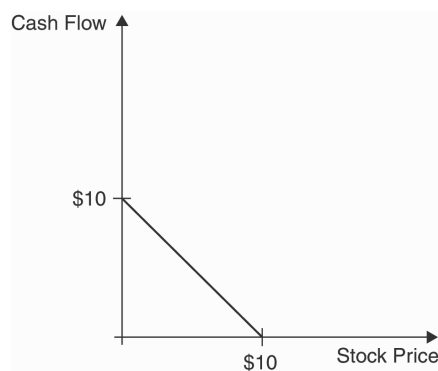


Evaluate: At a stock price of \$55, a short of the call option would be worth $-\$15$. At a stock price of \$35, the short of the call option would be worth 0.

4. **Plan:** Value the put if the stock is selling at \$8 and \$23. Draw a payoff diagram showing the value of the put as a function of the stock price at expiration.

Execute: Long put value at expiration:

- \$2
- \$0
- Draw payoff diagram:

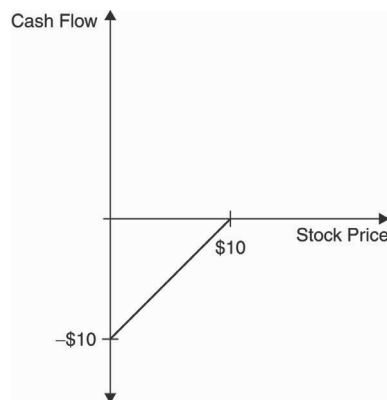


Evaluate: At a stock price of \$8, the put option would be worth \$2. At a stock price of \$23, the put option would be worth 0.

5. **Plan:** Value a short of the put if the stock is selling at \$8 and \$23. Draw a payoff diagram showing the value of the short of the call as a function of the stock price at expiration.

Execute: Short put value at expiration:

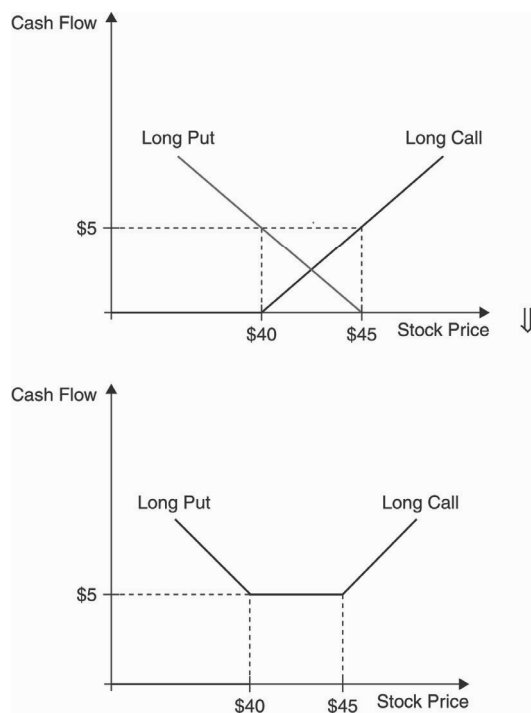
- You owe \$2.
- You owe nothing.
- Draw payoff diagram:



Evaluate: At a stock price of \$8, the put option will be worth \$2, so by shorting it, you will owe \$2. At a stock price of \$23, the short of the put option would be worth 0.

6. **Plan:** Plot the value of this put/call combination as a function of the stock price on the exercise date.

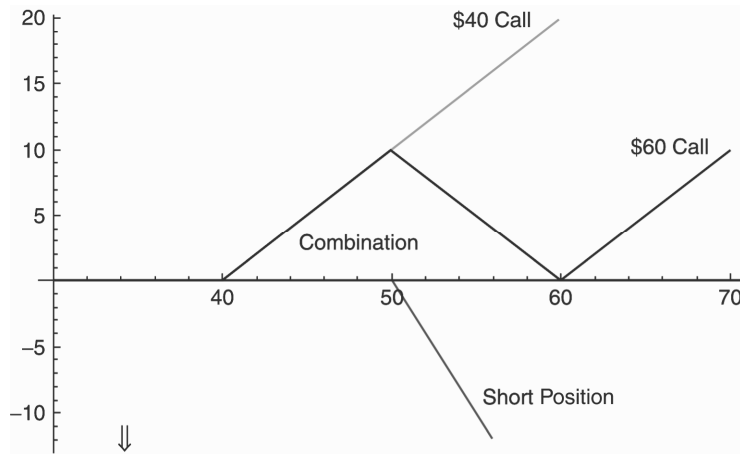
Execute:



Evaluate: You will make the most money if the stock closes below \$40 per share or above \$45 per share.

7. **Plan:** Plot the value of this put/call combination as a function of the stock price on the exercise date.

Execute:



This is called a Butterfly Spread.

Evaluate: The highest return is made if the stock is priced at \$50 on the exercise date.

- *8. **Execute:** A forward with price p can be constructed longing a call and shorting a put with strike p .
9. **Execute:** To protect against a fall in the price of Costco, you can buy a put with Costco as the underlying asset. By doing this, over the life of the option you are guaranteed to get at least the strike price from selling the stock you already have.
10. **Evaluate:** The maximum value of a call is the stock price, and the maximum value of a put is the strike price.
11. **Evaluate:** The American option with the longer time to expiration has all the same rights and privileges that the short time to expiration option has, plus additional rights and privileges. These additional benefits are usually worth something.
12. **Plan:** Using put/call parity determine the value of the European call option with a strike price of \$35.

Execute: Put/call parity:

$$\begin{aligned}
 C &= P + S - \frac{K}{1+r} \\
 &= 2.10 + 33 - \frac{35}{1.1} \\
 &= 3.282
 \end{aligned}$$

Evaluate: The European call option would have a value of \$3.282.

13. Plan: Price the call and determine if there is an arbitrage opportunity.

Execute: The arbitrage opportunity exists because

$$\$7 > \$3.33 + \$20 - \frac{\$18}{(1 + 0.08)} = \$6.66.$$

Evaluate: So, the call is overpriced compared to the portfolio of a put, the stock, and risk-free borrowing.

As a result, the strategy would be to sell the call option, buy the put, buy the stock, and borrow \$16.67 (the present value of \$18).

The net amount left after doing this is \$0.34, with no cash flows when the options expire.

- *14. Evaluate:** An equity holder is long a put on a share of the value of the firm assets with the per share value of debt as the strike price, long a share on the assets of the firm, and short a loan worth the value per share of the debt.
- 15. Evaluate:** Debt can be viewed as a combination of being short on a put option with a strike price equal to the value of debt, and long a risk-free bond with face value equal to the value of the debt.

Chapter 22

Mergers and Acquisitions

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. a. and b.

Plan: Compute the exchange ratio and the number of shares you need to issue. Calculate the total earnings from the combined firm and then divide by the total number of shares that will be outstanding.

Execute:

- a. TargetCo's shares are worth \$25, and your shares are worth \$40. You will have to issue $25/40 (= 5/8)$ shares per share of TargetCo to buy it. That means that in aggregate, you have to issue $(5/8) \times 1 \text{ million} = 625,000$ new shares. After the merger, you will have a total of 1,625,000 shares outstanding (the original 1 million plus the 625,000 new shares). Your total earnings will be \$6 million. This comes from the \$4 per share \times 1 million shares = \$4 million you were earning before the merger and the \$2 per share \times 1 million shares = \$2 million that TargetCo was earning. Thus, your new EPS will be \$6 million/1.625 million shares = \$3.69.
- b. A 20% premium means that you will have to pay \$30 per share to buy TargetCo ($= \$25 \times 1.20$). Thus, you will have to issue $\$30/\$40 = 0.75$ of your shares per share of TargetCo, or a total of 750,000 new shares. With total earnings of \$6 million and total shares outstanding after the merger of 1,750,000, you will have EPS of \$6 million/1.75 million shares = \$3.43.

Evaluate:

At no premium, you must issue 625,000 new shares to exchange for Target's shares. That means that the combined earnings of the new firm will be divided by a total of 1.625 million shares. Without synergies or a premium, the earnings of the two firms are combined together, as are the shareholders. The larger earnings are spread among a larger number of shares. With a premium, you are paying more to the Target shareholders. They are getting a larger fraction of the new firm ($750,000/1,000,000$ versus $625,000/1,000,000$). The EPS goes down to the higher number of shares, and the bidder shareholders are worse off than in part (a) and the Target shareholders are better off than in part (a) (because of the premium, they have more shares, so they benefit even though the EPS has decreased).

- c. In part (a), the change in the EPS simply came from combining the two companies, one of which was earning \$4 per share and the other was earning \$2 per share. However, you will notice that even though TargetCo has half your EPS, it is trading for more than half your value. That is possible if TargetCo's earnings are less risky or if they are expected to grow more in the future. Thus, although your shareholders end up with lower EPS after the

transaction, they have paid a fair price, exchanging their \$4 per share before the transaction for either lower, but safer EPS after the transaction, or lower EPS that are expected to grow more in the future. Either way, focusing on EPS alone cannot tell you whether shareholders are better or worse off.

- d. **Plan:** Compute the total value of the combined company and divide it by the total earnings.

Execute:

If you simply combine the two companies without any indicated synergies, then the total value of the company will be \$40 million + \$25 million = \$65 million. You will have earnings totaling \$6 million, so your P/E ratio is $\$65/\$6 = 10.83$. Your P/E ratio before the merger was $\$40/\$4 = 10$, and TargetCo's was $\$25/\$2 = 12.5$.

Evaluate:

You can see that by buying TargetCo for its market price and creating no synergies, the transaction simply ends up with a company whose P/E ratio is between the P/E ratios of the two companies going into the transaction. Again, simply focusing on metrics like P/E does not tell you whether you are better or worse off. (Your P/E went up from 10 to 10.83, but your shareholders are no better or worse off.)

2. **Plan:** Value Target Co by multiplying its earnings per share by the P/E ratio of companies in its industry.

Execute: Target Co has \$2 in earnings, so if other companies in its industry are trading at 14 times earnings, then a starting point for a valuation of TargetCo in this transaction might be \$28 per share, implying a 12% premium ($\$28/\25).

Evaluate: Estimating Target Co's value by comparing it to other companies in the same industry is one starting point for a purchase price.

3. **Plan:** Calculate the CEO's portion of the loss: ownership stake multiplied by dollar loss and compare it to his compensation gain.

Execute: His portion of the \$50 million loss in firm value is 3%, or \$1.5 million. If his compensation increases by \$5 million, even for only one year, he will be better off by \$3.5 million. The CEO will be better off.

Evaluate: The CEO's personal incentives are to go through with the transaction even though it is bad for shareholders.

4. **Plan:** Use the premium to calculate the total price that must be offered and then base the exchange ratio off of that price.

Execute: The premium is 40%, so the compensation to Thor shareholders must be $1.4(40)$ or \$56. Loki's shares are worth \$50, so it will need to offer $\$56/\$50 = 1.12$ shares of Loki for every share of Thor.

Evaluate: The premium directly affects the exchange ratio. The higher the premium, the higher the exchange ratio.

- 5. Plan:** Calculate the number of shares of LE by dividing the total value by price per share. Then calculate the total value with synergies and the implied price per share. Because that implied price per share fully assigns the synergies to LE, it is the most NFF could pay without overpaying.

Execute: First, calculate the number of shares of LE:

$$\text{Number of shares} = \frac{\$4,000,000,000}{\$25} = 1,600,000,000$$

Including synergies, LE will be worth \$4 billion + \$1 billion = \$5 billion, or \$31.25 per share (= \$5 billion/1.6 billion).

Hence, the maximum exchange ratio that NFF can offer is:

$$\text{Exchange ratio} = \frac{\$31.25}{\$35} = 0.893$$

Thus, NFF can offer a maximum exchange ratio of 0.893 of its share in exchange of each share of LE.

Evaluate: If NFF offers a higher exchange ratio, it will be paying LE more than the total value of LE including all synergies created by the merger. Thus, it will be overpaying, and transferring value from NFF shareholders to LE shareholders.

- 6. Plan:** Calculate the price per share of the new company by dividing the total value by the total number of shares that will be outstanding. Because bidder shares will survive and TargetCo shares will be exchanged, the bidder shares will have this value immediately after the announcement. TargetCo shares will be valued based on the exchange ratio. Finally, comparing the new price of TargetCo to the old price of TargetCo, you can calculate the actual premium.

Execute:

- Because 0.75 million new shares will be issued, the share price will be $(40 + 25)/1.75 = \$37.143$.
- Same as the price after the merger, \$37.143.
- Because TargetCo shareholders will receive $0.75 \times 37.143 = 27.86$ million and there are 1 million shareholders, the share price will be \$27.86.
- $27.86/25 - 1 = 11.43\%$.

Evaluate: Taking into account the changes in stock prices after the announcement, the true premium will be 11.43%.

- 7. Plan:** Because there are no synergies, any premium is a pure transfer from ABC shareholders to XYZ shareholders, so the value of ABC must decrease by the total value of the premium.

Execute:

- Upon the announcement, the price of XYZ will rise to \$3. This is a premium of 20% over its pre-announcement price ($3/2.5 = 1.20$).

The total premium paid will be \$0.50 per share for 1 million shares, or \$500,000. So, the value of ABC must decline by \$500,000. ABC is worth \$20 per share and has a million shares, so its value is \$20 million but is \$19.5 million after accounting for the \$500,000 premium transferred to XYZ. The price per share is then \$19.50.

- b. ABC will issue 0.15 million shares (0.15×1 million XYZ shares) so that the total number of shares for the combined company is 1.15 million shares. Because ABC will survive, each ABC share will have the value of a share of the combined company. The combined company is worth \$20 million (ABC) plus \$2.5 million (XYZ). ABC price = price of combined company = \$22.50 million/1.15 million shares = \$19.5652.

The market knows that each XYZ share will become 0.15 shares in the combined entity, so XYZ price = amount shareholders will receive = $0.15 \times \$19.5652 = \2.9345 .

Premium = $2.9345/2.5 = 17.4\%$ premium

- c. No, the premium in the stock offer is lower because market prices change to reflect the fact that ABC shareholders are giving XYZ shareholders money because they are paying a premium. The part (b) announcement means XYZ stock goes up and ABC stock goes down, which lowers the premium relative to the cash offer.

Evaluate: In a cash offer, the premium is fixed in dollar terms, but in a stock offer, the premium is defined by the exchange ratio, such that the actual premium paid fluctuates with the stock prices.

8. **Plan:** A new share will be issued at a 50% discount for every share that you do not own. Your percentage ownership will then decrease due to the flood of new shares. The price will also decrease because new shares have been sold at a discount. You can calculate the effect on your holdings by comparing the prices from before to after the pill trigger.

Execute:

- a. If you trigger the poison pill, then you own 20% of the company, or 400,000 shares ($= 20\% \times 2,000,000$ shares). When you trigger the poison pill, every other shareholder will buy a new share for every share they hold, so 1,600,000 shares ($= 2,000,000 - 400,000$) will be issued. These shares will be issued at \$10, which is 50% of the price immediately before triggering the poison pill (which we assume stays constant at \$20).
- b. After the new 1,600,000 shares are issued, there will be a total of 3,600,000 shares ($= 2,000,000 + 1,600,000$). You will own 400,000 of them, so your participation will be 11.11% ($= 400,000/3,600,000$).
- c. When the poison pill is triggered, the market value of the firm will increase to \$56 million [$= (\$20 \times 2,000,000) + (\$10 \times 1,600,000)$]. The new stock price will be \$15.56 ($= \56 million/3,600,000).
- d. You lose from triggering the poison pill (you bought shares at \$20 that are now worth \$15.56). Every other shareholder in the target firm gains—they end with \$31.12 ($= \15.56×2) worth of shares for which they only paid \$30 ($= \$20 + \10).

Evaluate: Poison pills are very effective because they simultaneously transfer money from the bidder to the other shareholders while reducing the bidder's voting stake in the company.

- 9. Plan:** The post-takeover value of the firm will be the \$40 million it is currently worth ($\$20 \times 2$ million shares) plus 40%. If you get control, you can assign the debt to the company. The equity value will be the total value minus the debt, and the price per share can then be calculated. Shareholders will tender if the post-takeover price is expected to be less than the \$25 you are offering.

Execute:

- a. The value should reflect the expected improvement that you will make by replacing the management, so the value of the company will be \$40 million plus 40% = \$56 million. If you buy 50% of the shares for \$25 apiece, you will buy 1 million shares, paying \$25 million. However, you will borrow this money, pledging the shares as collateral and then assign the loan to the company once you have control. This means that the new value of the equity will be \$56 million – \$25 million in debt = \$31 million. With 2 million shares outstanding, the price of the equity will drop to \$15.50.
- b. Because the price of the shares will drop from \$20 to \$15.50 after the tender offer, everyone will want to tender their shares for \$25.
- c. Assuming that everyone tenders their shares and you buy them all at \$25 apiece, you will pay \$50 million to acquire the company, and it will be worth \$56 million. You will own 100% of the equity, which will be \$56 million – \$50 million loan to buy the shares = \$6 million.

Evaluate: You can take over the company, increase the value, and capture \$6 million of the value change.

Chapter 23

International Corporate Finance

Note: All problems in this chapter are available in MyFinanceLab. An asterisk (*) indicates problems with a higher level of difficulty.

1. **Plan:** Calculate how many English pounds you could buy with \$500.

Execute:

$$\$500 \div \frac{1.95}{\text{£}1} = \text{£}256.41$$

Evaluate: You could buy 256.41 English pounds with \$500.

2. **Plan:** Calculate how many U.S. dollars you will need to exchange to receive 500,000 European euros.

Execute:

$$\text{€}500,000 \div \frac{\text{€}0.65}{\$1} = \$769,230.77$$

Evaluate: You would have to exchange \$769,230.77 to receive 500,000 euros.

3. **Plan:** Calculate the number of Polish zloty you must be paid in three months to receive \$100,000 in exchange. Also determine what the difference between the spot and three-month forward zloty/dollar exchange rate is telling you about relative interest rates in the United States and Poland.

Execute:

- a. You can lock in an exchange rate of 2.2595 PLN/\$. You should require 225,950 PLN to receive \$100,000.

Evaluate:

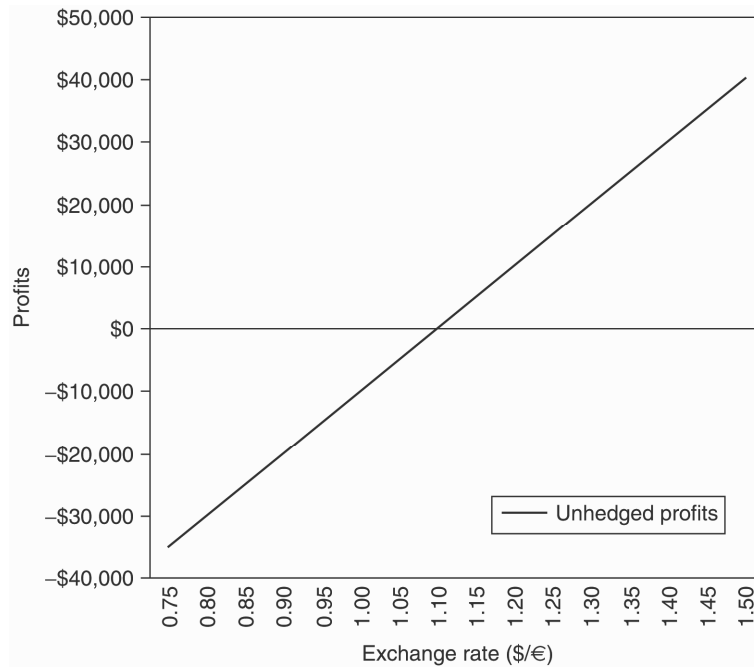
- b. Because the spot rate is higher than the forward rate, the Polish interest rate must be lower than that of the United States.



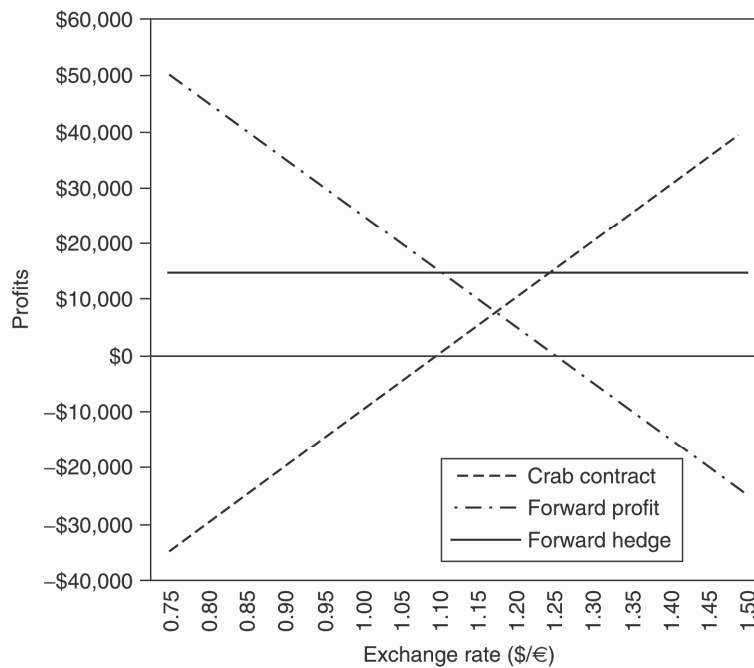
4. **Plan:** Draw the graphs requested in the problem. And determine which type of hedge has the least downside risk in the event of a cancellation.

Execute:

a.

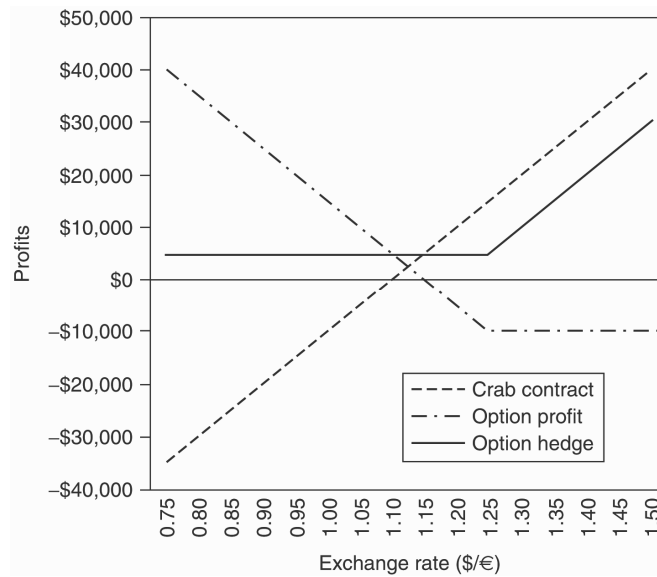


b.

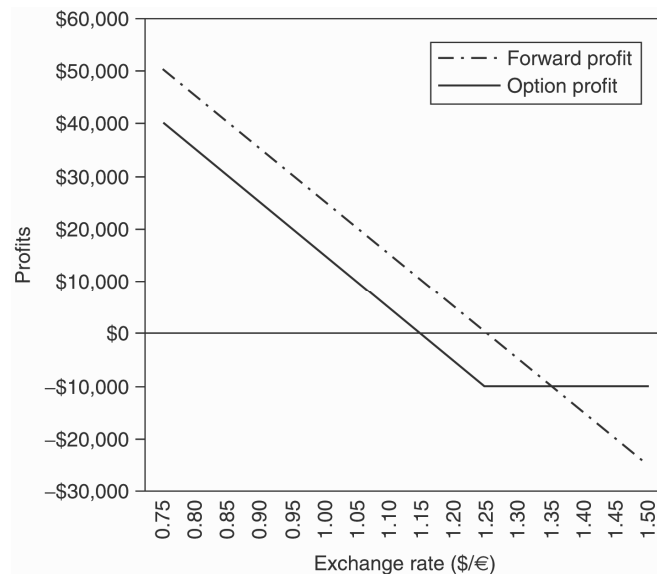


- c. In order to hedge the risk of the profits, you want to buy a put option; this protects you from a drop in the exchange rate.

d.



e.



Evaluate: The option hedge has the least downside risk in the event of cancellation. There exists the potential for unlimited losses while holding a forward contract if the exchange rate climbs significantly, while the losses holding an option contract are limited to \$10,000.

5. **Plan:** Calculate the present values of converting into dollars and discounting and of converting into euros and then discounting. Do these currency markets appear to be integrated?

Execute:

- a.
$$\frac{\text{€}5 \text{ million}}{1.07} = \text{€}4.67 \text{ million}$$

$$\text{€}4.67 \text{ million} \times \frac{\$1.25}{\text{€}} = \$5.841 \text{ million}$$
- b.
$$\text{€}5 \text{ million} \times \frac{\$1.215}{\text{€}} = \$6.075 \text{ million}$$

$$\$6.075 \text{ million} \times \frac{1}{1.04} = \$5.841 \text{ million}$$

Evaluate:

- c. According to the results of (a) and (b), which are identical at \$5.841 million, these markets appear to be internationally integrated.
6. **Plan:** Calculate the present values of converting into dollars and discounting and of converting into rupees and then discounting. If the values are the same, then the markets are internationally integrated.

Execute:

- a.
$$\frac{400 \text{ million rupee}}{1.10} = 363.6364 \text{ million rupee}$$

$$363.6364 \text{ million rupee} \times \frac{\$0.022}{\text{rupee}} = \$8 \text{ million}$$
- b.
$$400 \text{ million rupee} \times \frac{\$0.021}{\text{rupee}} = \$8.4 \text{ million}$$

$$\$8.4 \text{ million} \times \frac{1}{1.05} = \$8 \text{ million}$$

Evaluate:

- c. According to the results of (a) and (b), which are identical at \$8 million, these markets appear to be internationally integrated.



7. **Plan:** Compute the forward exchange rate between the dollar and the euro. Convert the euro cash flows into dollars and discount them to determine the project's net present value. Accept the project if NPV is positive; reject if NPV is negative.

Execute: First, calculate the forward rates:

$$F_1 = (\$1.15/\text{€}) \frac{(1.04)}{(1.06)}$$

$$= \$1.1283/\text{€}$$

$$F_2 = (\$1.15/\text{€}) \frac{(1.04)^2}{(1.06)^2}$$

$$= \$1.1070/\text{€}$$

$$F_3 = (\$1.15/\text{€}) \frac{(1.04)^3}{(1.06)^3}$$

$$= \$1.0861/\text{€}$$

$$F_4 = (\$1.15/\text{€}) \frac{(1.04)^4}{(1.06)^4}$$

$$= \$1.0656/\text{€}$$

Next, convert euro cash flows into dollars:

Year	Euro Cash Flow	Exchange Rate	Dollar Cash Flow
0	-15	1.1500	-17.250
1	9	1.1283	10.155
2	10	1.1070	11.070
3	11	1.0861	11.947
4	12	1.0656	12.788

Finally, the net present value is:

$$\begin{aligned} \text{NPV} &= -17.250 + \frac{10.154}{1.085} + \frac{11.070}{1.085^2} + \frac{11.947}{1.085^3} + \frac{12.788}{1.085^4} \\ &= \$20.094 \text{ million} \end{aligned}$$

Evaluate: Etemadi Amalgamated should undertake the project because the net present value is positive.



8. Plan: Redo Problem 7 with the new exchange rates.

Execute: With the 26% drop in the spot rate, the forward rates need to be recalculated:

$$F_1 = (\$0.85/\text{€}) \frac{(1.04)}{(1.06)}$$

$$= \$0.83396/\text{€}$$

$$F_2 = (\$0.85/\text{€}) \frac{(1.04)^2}{(1.06)^2}$$

$$= \$0.81823/\text{€}$$

$$F_3 = (\$0.85/\text{€}) \frac{(1.04)^3}{(1.06)^3}$$

$$= \$0.80279/\text{€}$$

$$F_4 = (\$0.85/\text{€}) \frac{(1.04)^4}{(1.06)^4}$$

$$= \$0.78764/\text{€}$$

Next, euro cash flows are reconverted into dollars:

Year	Euro Cash Flow	Exchange Rate	Dollar Cash Flow
0	-15	0.85000	-12.750
1	9	0.83396	7.506
2	10	0.81823	8.182
3	11	0.80279	8.831
4	12	0.78764	9.452

Finally, the net present value is:

$$\begin{aligned} \text{NPV} &= -12.750 + \frac{7.506}{1.085} + \frac{8.182}{1.085^2} + \frac{8.831}{1.085^3} + \frac{9.452}{1.085^4} \\ &= \$14.852 \text{ million} \end{aligned}$$

Evaluate: Etemadi Amalgamated should still undertake the project because the net present value is positive. Note that this is 26% lower than the answer in 23.7, which is consistent with the 26% drop in the spot exchange rate.

9. **Plan:** Use the law of one price to calculate the euro cost of capital given the dollar WACC and exchange rates.

Execute: The Law of One Price tells us:

$$(1 + r_{\text{€}}^*) = \frac{S}{F}(1 + r_{\text{\$}}^*)$$

As a result, we have:

$$\begin{aligned} r_{\text{€}}^* &= \frac{S}{F}(1 + r_{\text{\$}}^*) - 1 \\ &= \frac{1.2}{1.157} \times (1 + 0.08) - 1 \\ &= 12.014\% \end{aligned}$$

Evaluate: Our dollar-denominated WACC of 8% translates into a 12.014 euro cost of capital.

10. **Plan:** Use the formula for the International Cost of Capital to determine the Japanese yen cost of equity.

Execute: Using the formula for the Internationalization of the Cost of Capital, we have:

$$1 + r_{\text{¥}}^* = \frac{1 + r_{\text{¥}}}{1 + r_{\text{\$}}^*}(1 + r_{\text{¥}}^*)$$

As a result, we obtain:

$$\begin{aligned}r_{¥}^* &= \frac{1+r_{¥}}{1+r_{\$}}(1+r_{\$}^*)-1 \\&= \frac{1+0.01}{1+0.05} \times (1+0.11)-1 \\&= 6.771\%\end{aligned}$$

Evaluate: The Japanese yen cost of equity is 6.771%.

- 11. Plan:** Calculate the after-tax cost of debt in dollars. Then use the formula for the International Cost of Capital to determine the Japanese yen cost of debt.

Execute: The after-tax cost of debt in dollars is $(0.075)(1 - 0.30) = 0.0525$ or 5.25%.

Using the formula for the Internationalization of the Cost of Capital, we have:

$$1+r_{¥}^* = \frac{1+r_{¥}}{1+r_{\$}}(1+r_{\$}^*)$$

As a result, we obtain:

$$\begin{aligned}r_{¥}^* &= \frac{1+r_{¥}}{1+r_{\$}}(1+r_{\$}^*)-1 \\&= \frac{1+0.01}{1+0.05} \times (1+0.0525)-1 \\&= 1.24\%\end{aligned}$$

Evaluate: The Japanese yen cost of debt is 1.24%.

- 12. Plan:** Use the formula for the International Cost of Capital to determine the euro cost of capital. Then calculate the project's net present value.

Execute:

- a. Using the formula for the Internationalization of the Cost of Capital, we have:

$$1+r_{€}^* = \frac{1+r_{€}}{1+r_{\$}}(1+r_{\$}^*)$$

As a result, we obtain:

$$\begin{aligned}r_{€}^* &= \frac{1+r_{€}}{1+r_{\$}}(1+r_{\$}^*)-1 \\&= \frac{1+0.07}{1+0.045} \times (1+0.095)-1 \\&= 12.12\%\end{aligned}$$

$$\begin{aligned} \text{b. NPV} &= -25 + \frac{12}{1.1212} + \frac{14}{1.1212^2} + \frac{15}{1.1212^3} + \frac{15}{1.1212^4} \\ &= \text{€}16.975 \text{ million} \end{aligned}$$

Evaluate: Because the net present value of the project is positive, it should be accepted.

- 13. Plan:** Calculate Tailor Johnson's U.S. tax liability on its Ethiopian operations given the exchange rate and the tax rates in each country.

Execute: With earnings of 100 million birrs and the Ethiopian tax rate of 25%, the tax paid in Ethiopia is 25 million birrs. With an exchange rate of 0.125/birr, the earnings amount to \$12.5 million, and the Ethiopian taxes amount to \$3.125 million. With a tax rate of 45%, the U.S. tax on Tailor Johnson's Ethiopian income would be $0.45 \times 12.5 = \$5.625$ million. However, Tailor Johnson is able to claim a tax credit of \$3.125, for a net tax liability of $5.625 - 3.125 = \$2.5$ million.

Evaluate: Tailor Johnson would have a net U.S. tax liability of \$2.5 million on its profits from Ethiopian operations.

- *14. Plan:** Determine the present value of deferring the U.S. tax liability on Tailor Johnson's Ethiopian earnings for 10 years. And estimate how the exchange rate in 10 years will affect the actual amount of the U.S. tax liability.

Execute:

- From Question 22.13, the tax liability is \$2.5 million. Deferred for 10 years, using the after-tax cost of debt at 5%, the present value is $2.5/1.05^{10} = \$1.53$ million. Hence, the value of deferral is $2.5 - 1.53 = \$0.97$ million.
- The earnings will need to be converted at the future exchange rate, S_{10} , although the tax credit will still be calculated at $S_1 = \$0.125/\text{birr}$.

Evaluate: Hence, the U.S. tax liability will be $(0.45)(S_{10})(100) - 3.125$.

- 15. Plan:** Calculate Peripatetic's U.S. tax liability on earnings from its operation in Poland and Sweden. Then determine the U.S. tax liability by pooling.

Execute:

- The net U.S. tax liability, after claiming the credit for taxes paid in Poland, is $(0.45)(80) - 16 = \$20$ million.
- The net U.S. tax liability, after claiming the credit for taxes paid in Sweden, is $(0.45)(100) - 60 = -\$15$ million. However, the use of the tax credit is limited to the U.S. tax liability, so the liability is actually zero. This is an excess tax credit of \$15 million that is lost.
- Pooling the Polish and Swedish subsidiaries, the net U.S. tax liability is: $(0.45)(180) - 76 = \$5$ million.

Evaluate: By pooling, Peripatetic Enterprises is able to use the \$15 million excess tax credit from earnings in Sweden to offset \$15 million of the \$20 million net tax liability from earnings in Poland, leaving a net U.S. tax liability of \$5 million.

- *16. Plan:** Compute the Russian risk-free rate of interest. The amount of interest the Russian government must pay on its bonds above the risk-free rate is the implied credit risk spread.

Execute: From covered interest parity, the forward and spot ruble/\$ exchange rates satisfy:

$$F = S \times \frac{1 + r_R}{1 + r_{\$}}$$

where r_R and $r_{\$}$ are risk-free interest rates in rubles and dollars, respectively. With this equation, we can use the spot and forward exchange rates and the risk-free dollar interest rate to solve for the risk-free ruble interest rate:

$$28.5 = 28 \times \frac{1 + r_R}{1.045}$$

which implies

$$\begin{aligned} r_R &= 28.5 \times \frac{1.045}{28} - 1 \\ &= 6.37\%. \end{aligned}$$

Evaluate: Therefore, the implied risk-free ruble interest rate is 6.37%, implying that Russian government bonds have an implied credit spread of $7.5\% - 6.37\% = 1.13\%$ to compensate investors for the possibility of the Russian government defaulting.

(See Example 23.6 for a similar problem. Note also that an investor can obtain a risk-free investment in rubles by exchanging rubles for dollars at the spot rate of 28 rubles/\$, investing in U.S. Treasuries at 4.5%, and locking in a forward exchange rate of 28.5 rubles/\$ to convert the proceeds back to rubles. The rate r_R computed above is the effective return from this transaction.)



***17. Plan:** Compute the free cash flows of the project and calculate their net present value.

Execute: The solution to this problem is in the following Excel spreadsheet:

	0	1	2	3	4
Sales in UK		0	0	0	0
Cost of Sales		-15.625	-15.625	-15.625	-15.625
Gross Profit		-15.625	-15.625	-15.625	-15.625
Operating Expenses	-4.167	-5.625	-5.625	-5.625	-5.625
Depreciation		-3.75	-3.75	-3.75	-3.75
EBIT	-4.167	-25	-25	-25	-25
Less: Taxes	1.667	-5	-5	-5	-5
Plus: Depreciation		3.75	3.75	3.75	3.75
Less: Capital Expenditures	-15				
FCF (£ millions)	-17.500	-26.250	-26.250	-26.250	-26.250
Forward Exchange Rate	1.6000	1.5551	1.5115	1.4692	1.4280
FCF (\$ millions)	-28.000	-40.822	-39.678	-38.565	-37.484
Sales in the U.S.		60	60	60	60
CF (\$ millions)	-28.000	19.178	20.322	21.435	22.516
WACC	6.80%				
NPV (\$ millions)	42.6749				

Evaluate: The net present value is positive indicating that the project is acceptable.