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■ ***Instructor's Manual*** The *Instructor's Manual* includes syllabi for several courses (both undergraduate and master's level) that have been used in this book. It also includes lecture notes on each chapter, answers to the review and discussion questions at the end of each chapter, and teaching notes on the case studies that have been prepared by the textbook authors.

■ ***Test Item File and TestGen Software*** The Test Item File includes multiple-choice and True/False questions for each chapter in this textbook. The Test Item File is available in Microsoft Word and for use with the computerized Prentice Hall TestGen, as well as WebCT and Blackboard-ready conversions. TestGen is a comprehensive suite of tools for testing and assessment. Screen wizards and full technical support are available to instructors to help them create and distribute tests to their students, either by printing and distributing through traditional methods or by online delivery.

■ ***PowerPoint Slides*** The PowerPoint slides that have been developed for this edition emphasize the key concepts in the text, include many of the figures in the text, and provide some Web links to enhance student learning. Faculty instructors can customize these presentations by adding their own slides and links to Web resources and/or by editing the existing ones.

■ ***The Image Library*** is a collection of the text art organized by chapter. This collection includes all of the figures, tables, and screenshots (as permission allows) from the book. These images can be used to enhance class lectures and PowerPoint slides.

The Graduate Information Technology Management Course

This book is written for students who are, or aspire to be, *either business managers or IS managers*, as well as for students who are, or aspire to be, primarily technology specialists who will work in and for different types of businesses—including consultant firms and other firms competing in an IT services industry. The content of the book is therefore intentionally broad in its coverage, with an emphasis on what managers *and* IS professionals need to know about IT management.

Part I of the textbook can be used as background reading only—especially if the course is for IT specialists familiar with most of these IT concepts. For business students with less familiarity, other approaches may be required—such as independent reading with assessments using quizzes based on the text bank questions for those chapters—and/or providing lectures on these topics.

Part II provides a broad introduction to the range of applications available to today's organizations, and the business opportunities enabled by them. Our experience is that the content in these three chapters is of great interest to working managers as well as younger students.

Part III primarily focuses on the management of software development initiatives: alternative approaches to acquiring and implementing custom-developed and purchased software and managing IT projects of different types them.

Part IV informs both business and IS managers of what is required to effectively manage and lead an IS organization today; the last chapter also addresses broader IT-related social, ethical and legal issues.

The graduate IT management course therefore focuses on preparing students for responsibilities that entail leveraging IT resources for operational and strategic business benefits.

Examples of Master's Level Courses

There are many variations of MBA and MSIS courses for which this book can be used. In the past, the textbook authors have used the textbook for different courses over the years at Indiana University: an IT management course in the full-time MBA program at the Bloomington campus and the evening MBA program at the Indianapolis campus; a course in our full-time MBA in Accounting program at the Bloomington campus; a course in an Executive MBA program; a course in our online MBA and Master's programs (Kelley Direct), and a course in our full-time Master's in Information Systems program. The outlines that follow can be modified for full-time twice-a-week, one evening a week, and online course schedules.

Our experience is that graduate-level courses are most effective when students are involved in discussions and projects. The following course outline therefore uses the case studies in the book to obtain student involvement. All of these cases are based on data collected from real organizations. Although some of the companies are disguised, only non-essential contextual information and names have been changed to camouflage these sources.

Case studies can of course be used in many ways. For each case study in the textbook, we provide in this *Instructor's Manual* the case study objectives, an overview, and some discussion questions; for some cases we also provide additional teaching suggestions. A common approach is to have the instructor lead the case study discussion, asking students to outline the situation, identify the problems, and suggest solutions. With this approach, we often distribute some preparation questions ahead of time to guide the students' reading of the case—but then ask some different questions in class. This discussion can be handled either by taking volunteers from the class to move the discussion forward, or by “cold-calling” on students using some kind of random selection process. Here the instructor can make sure that many of the major points he or she wants to cover on the topic are brought out and discussed via the case study. One way to ensure participation in each case discussion is to raise a question that requires each student to “vote,” and then call on students to justify their vote. If case studies are carefully chosen, they should tie in well with the associated chapter, so lecturing can be minimized.

Another approach for graduate classes involves dividing the class into teams of 4 or 5 students, and having each team prepare a written analysis of one case study and make a formal presentation of that case study to the entire class. A second team could also be given the assignment to critique the in-class presentation. (See the description for students called “Team Case Assignments” that follows the graduate course outlines below.) The instructor can then ask follow-up questions of both teams to ensure that the most important points have been discussed. Each member of the audience can be asked to fill out a short evaluation form on each team presentation, and the instructor aggregates the results and adds their own observations as part of their feedback to the

team. We may also videotape the presentation and ask each presenter to write a short critique of his or her own presentation. The number of team presentations scheduled for a given class meeting depends on the size of the class, but including team presentations gives students the opportunity to develop their communications skills, as well as their effectiveness in teamwork, all of which are very important for MBAs.

The first two course outlines below follow the book very closely, but it can easily be modified in many ways to suit instructor preferences. For example, the chapters have been written to be as independent as possible, but we sometimes vary the order in which the chapters are covered. You can also modify the amount of time devoted to the various topics. For example, one outline devotes class time to the technical chapters (Chapters 2 and 3), but if your students already have a good technical education, you may be able to omit these chapters entirely or perhaps schedule an optional session on this material. Alternatively, if you believe it is important to ensure that your students have a broad knowledge of technology concepts, you may choose to spend several class periods on each of these chapters.

For graduate-level examinations, we recommend a heavy usage of essay questions. If multiple choice questions are used for the technology chapters, we recommend scheduling them early in the semester and setting a score minimum score that must be obtained (e.g., 85%). For students that don't obtain that score, a similar "retake" quiz is then made available that requires the students to learn on their own what was wrong with their initial set of answers to prepare for the second quiz on the same topics.

Master's IT Management Course Outline (Full-Time Students)

The following course outline is for full-time students. The schedule is two 75-minute classroom sessions per week, a fifteen-week semester, and a separate final examination period.

Week	Session	Topic	Reading Assignment / Case Study Assignment
Week 1	First	Course Introduction; Managing IT in a Digital World	Chapter 1
	Second	Managing IT in a Digital World	Midsouth Chamber of Commerce (A)
Week 2	First	Computer Systems (Hardware)	Chapter 2; IMT Custom Machine Company, Inc.
	Second	Computer Systems (Software)	Chapter 2
Week 3	First	Telecommunications and Networking	Chapter 3
	Second	Telecommunications and Networking	Supporting Mobile Health Clinics
Week 4	First	The Data Resource	Chapter 4; Data Governance at InsuraCorp
	Second	Enterprise Systems	Chapter 5; ERP Purchase Decision at Benton Manufacturing, Inc.
Week 5	First	Enterprise Systems	Real-Time Business Intelligence at Continental Airlines
	Second	Managerial Support Systems	Chapter 6; Mining Data to Increase State Tax Revenues in California
Week 6	First	E-Business Systems	Chapter 7; Vendor-Managed Inventory at NIBCO
	Second	E-Business Systems	The Cliptomania Web Store
Week 7	First	Review	
	Second	MIDTERM EXAMINATION	
Week 8	First	Basic Systems Concepts	Chapter 8
	Second	Methodologies for Custom Software Development	Chapter 9
Week 9	First	Methodologies for Custom Software Development	Managing a Systems Development Project at Consumer & Industrial Products, Inc.
	Second	Methodologies for Purchased Software Packages	Chapter 10; A Make-or-Buy Decision at Baxter Manufacturing Company
Week 10	First	Methodologies for Purchased Software Packages	Purchasing and Implementing a Student Management System at Jefferson Country School System
	Second	IT Project Management	Chapter 11
Week 11	First	IT Project Management	NIBCO's "Big Bang": An SAP Implementation
	Second	IT Project Management	A Troubled Project at Modern

Week	Session	Topic	Reading Assignment / Case Study Assignment
			Materials, Inc. <i>or</i> Kual Financial Systems: An Open Source Project
Week 12	First	Planning Information Systems Resources	Chapter 12; H.H. Gregg's Applicances, Inc.: Deciding on a New IT Platform
	Second	Planning Information Systems Resources	The Clarion School for Boys, Inc. -Milwaukee Division
Week 13	First	Leading the IS Function	Chapter 13
	Second	Leading the IS Function	IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 14	First	Leading the IS Function	FastTrack IT Integration for the Sallie Mae Merger
	Second	Leading the IS Function	Systems Support for a New Baxter Manufacturing Plant in Mexico <i>or</i> Meridian Hospital Systems, Inc.: Deciding Which IT Company to Join
Week 15	First	Information Security	Chapter 14
	Second	Social, Ethical, and Legal Issues	Chapter 15; Mary Morrison's Ethical Dilemma
Week 16		FINAL EXAMINATION	

Master's IT Management Course Outline (Evening or Weekend Students)

This outline is for a Master's IT course that meets once a week in the evening or on a Saturday. This syllabus also includes team project presentations (a Web Site Analysis project described in this *Instructor's Manual* for Ch. 7), a guest speaker (as recommended for Ch.13), and two exams.

Week	Topic	Reading Assignment / Case Study Assignment
Week 1	Course Introduction; Managing IT in a Digital World	Chapter 1; Midsouth Chamber of Commerce (A)
Week 2	Computer Systems	Chapter 2; Web Site Analysis assignment introduced
Week 3	Telecommunications and Networking; The Data Resource	Chapter 3; Chapter 4; Supporting Mobile Health Clinics; Data Governance at InsuraCorp.
Week 4	Enterprise Systems; Using IT to Redesign Processes	Chapter 5; NIBCO's "Big Bang"
Week 5	Managerial Support Systems	Chapter 6; Real-Time Business Intelligence at Continental Airlines
Week 6	E-Business Systems	Chapter 7; Vendor-Managed Inventory at NIBCO; Rock Island Chocolate Company
Week 7	Team Presentations: Web Site Analysis	Web Site Analysis Due
Week 8	MIDTERM EXAMINATION	
Week 9	Basic Systems Concepts; Methodologies for Custom Software Development	Chapter 8 (skim); Chapter 9; Consumer & Industrial Products, Inc.
Week 10	Methodologies for Purchased Software Packages	Chapter 10; Make-or-Buy Decision at Baxter Manufacturing Company
Week 11	IT Project Management	Chapter 11; A Troubled Project at Modern Materials, Inc.
Week 12	Planning IS Resources	Chapter 12; H.H. Gregg's Appliances, Inc.
Week 13	Leading the IS Function	Chapter 13; IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 14	Leading the IS Function; Guest Speaker: CIO	FastTrack IT Integration for the Sallie Mae Merger
Week 15	Information Security; Social, Ethical, and Legal Issues	Chapter 14; Chapter 15
Week 16	FINAL EXAMINATION	

Master's IT Management Course Outline (Online)

A course outline for an online course that takes place during a 12-week trimester schedule is given below. In this alternative, a readings packet (including *Harvard Business Review*, *Sloan Management Review*, and *MIS Quarterly Executive* articles) and digitized mini-lectures are used in addition to the textbook. For this course, the Chapters from different Parts of the textbook are assigned together, and online quizzes are provided to test for basic understanding of the technology concepts in Part 2.

Week	Topic	Reading Assignment / Case Study Assignment
	Unit 1: Introduction	Video: Introduction to the Course and Unit 1
Week 1	Course Introduction; Managing IT in a Digital World	Chapter 1; Chapter 15
	Unit 2: Understanding Business Opportunities Enabled by IT	Video: Introduction to Unit 2
Week 2	Recognizing Disruptive Technologies; Technology Concepts—Hardware and Software	Chapter 8 on BPR; reading on disruptive technologies; Chapter 2; IMT Custom Machine Company, Inc.
Week 3	Leveraging E-Business; Technology Concepts—Telecommunications and Networking	Chapter 7; reading on e-business leadership and influence of the Internet on competitive forces; Vendor-Managed Inventory at NIBCO; Rock Island Chocolate Company; Chapter 3
Week 4	The IT Business Case	Chapter 12; online PowerPoint presentations on a business case (in general and IT-specific); H.H. Gregg's Appliances
Week 5	MIDTERM EXAMINATION	
	Unit 3: Acquiring Information Systems	Video: Introduction to Unit 3
<i>Weeks 6 and 7</i>	Group Project Signup: Technologies in Business	Familiarization with tools for group project
Week 6	Strategic Value from Enterprise Systems	Chapter 4; Chapter 5; readings on CRM; Real-Time Business Intelligence at Continental Airlines
Week 7	Strategic Decision-Making Support	Chapter 6; Chapter 9; Mining Data to Increase State Tax Revenues in California
Week 8	The Delivery of Information Systems	Chapter 10; Chapter 11; reading on continuous improvement with enterprise systems; NIBCO's "Big Bang"
	Unit 4: Leveraging IT	Video: Introduction to Unit 4
Week 9	Sourcing IT Work	Chapter 13; readings on outsourcing trends, including BPO; IT Infrastructure

Week	Topic	Reading Assignment / Case Study Assignment
		Outsourcing at Schaeffer (A) and (B)
Week 10	Managing in a Global Digital World	Chapter 14; readings on managing global IT organizations; The Maxfli Sales Force Automation System at BAT
Week 11	Team Projects Due: Technologies in Business	

Team Case Assignments

Team Presentation

A problem-solving approach to case analysis will be introduced in class. For this approach, the team should take a consultant role, and assume that it was hired by the organization to:

Make use of your knowledge of IS management; Provide an objective opinion on one or more problems; Provide realistic options for action for this organization

For other cases, a problem-solving approach may not be relevant, and the team should take an educator role. The case may be viewed as a “textbook example” to be critiqued in relation to other class readings and/or experience.

Written Presentation

The text should be a maximum of 6 double-spaced pages. You should include copies of all tables, diagrams, etc. used in your presentation. The cover sheet should include team member names. Provide copies to each member of the critiquing team and 2 copies to the instructor.

Oral Presentation

The presentation should be your professional best, last no more than 30 minutes, and each team member should have a part. You should illustrate your presentation with PowerPoint slides; be sure that the fonts on these slides are readable when projected in your classroom.

Oral Critique

There will be a 5-minute break after the oral presentation while the critiquing team prepares. During this time the other class members will complete a presentation evaluation form for each presenter.

The critiquing team should point out the positive aspects of the case presentation as well as those areas where there may be room for improvement or alternative conclusions. If a problem-solving approach was appropriate for this case, the critiquing team should evaluate the case presentation for the following:

Accurate assessment of the current situation; Complete formulation of issues or problems; Technologically and organizationally sound recommendations for action

If a problem-solving approach was not appropriate, the critiquing team should evaluate the case presentation for:

Accurate presentation of the situation; Relevant application of class readings and experience

If your team has little to actually criticize about the earlier presentation, your team should at least present some alternative recommendations and the implications (or “next steps”) that you would recommend.

The Undergraduate Information Technology Management Course

This text has also been used with success at the undergraduate level. For the undergraduate student, the review and discussion questions at the end of each chapter can be used to help them focus on specific aspects of each chapter. We sometimes require that written answers be prepared for a small subset of these questions; these are evaluated by the instructor, but perhaps with only 3 grades given: A+, satisfactory, and unsatisfactory.

Several case studies are also assigned. Our experience is that this course may be the first one that students take that involves the use of case studies. If so, the instructor needs to provide some guidance to the student about how to go about preparing for a class discussion. The case studies also must be carefully selected so that the contextual details do not overwhelm a student that has had little (or essentially no) relevant work experience.

For this course we also recommend the use of computer laboratories/computer assignments to help students get some hands-on experience with some of the key concepts. In the following outline we have provided for five laboratory sessions and related assignments. This approach adds an element of variety in delivery to a predominantly lecture/discussion course. It is assumed that each laboratory session will take the form of a demonstration and/or laboratory exercise, and that most computer homework assignments will be given at the end of a laboratory session and due a few weeks later. Of course, the particular topics covered in these lab sessions will vary depending upon the coverage in prerequisite courses and the needs of your particular undergraduate program.

Several other points should be made about the course coverage. First, while a significant number of case study discussions are listed, these discussions do not tend to be as long or in as much depth as they would be in a graduate course. Our usual approach is to distribute the case study discussion questions via electronic mail two to three days before the class session, and then use these discussion questions to channel the case study discussion. Second, more complex case studies are assigned at the end of the course; by this time, the students should have increased their skills in case study problem-solving, but preparation questions should be used to help them focus on specific aspects of the case study. Third, we have shown the scheduling of a single guest speaker, but it may be useful to bring in more than one guest speaker for short presentations at other points during the semester.

We believe that the course described below provides a very useful capstone IT management course for the IS major. Together with a first course that is computer tools-oriented, we also believe that it can be effectively used as an MIS component for the non-IS undergraduate business major as well. The objective of both courses is to help prepare the undergraduate business major to be an effective user of information technology in his or her career.

Example of Undergraduate Level Course

Undergraduate IT Management Course Outline

This course outline assumes two 75-minute classroom sessions per week, a fifteen-week semester, and several lab sessions, and 3 examinations.

Week	Session	Topic	Reading Assignment / Case Study Assignment
Week 1	First	Course Introduction; Using Web resources	Web Mini-Assignment given with a focus on resources for learning about the topics in this course
	Second	Managing Information Technology in a Digital World	Chapter 1; Midsouth Chamber of Commerce (A); Web Mini-Assignment Due
Week 2	First	Computer Systems	Chapter 2
	Second	In-Class Lab Session: Advanced Hardware Concepts (How does a supercomputer work?)	
Week 3	First	Computer Systems	H.H. Gregg's Appliances, Inc.: Deciding on a New IT Platform
	Second	Telecommunications and Networking	Chapter 3
Week 4	First	Telecommunications and Networking	Supporting Mobile Health Clinics
	Second	Laboratory Session: Geographic Information Systems (GIS)	GIS Assignment Given
Week 5	First	Telecommunications and Networking	VoIP Adoption at Butler University; Review session
	Second	FIRST EXAMINATION	
Week 6	First	The Data Resource	Chapter 4
	Second	Laboratory Session: Decision Support Systems Using Microsoft Excel	GIS Assignment Due; Decision Support Systems Assignment Given
Week 7	First	Enterprise Systems	Chapter 5; ERP Purchase Decision at Benton Manufacturing, Inc.
	Second	Managerial Support Systems (including several demonstrations)	Chapter 6
Week 8	First	E-Business Systems	Chapter 7; The Cliptomania Web Store
	Second	Laboratory Session: Web Site Analyses	Decision Support Systems Assignment Due
Week 9	First	E-Business Systems	Rock Island Chocolate Company
	Second	Guest Speaker: Leveraging an ERP System	Assignment to prepare for Guest

Week	Session	Topic	Reading Assignment / Case Study Assignment
			Speaker presentation
Week 10	First	Laboratory Session: Microsoft Access	Web Site Analyses Due; Access Assignment Given
	Second	SECOND EXAMINATION	
Week 11	First	Basic System Concepts	Chapter 8
	Second	Methodologies for Custom Software Development	Chapter 9; Consumer and Industrial Products, Inc.
Week 12	First	Methodologies for Purchased Software Packages	Chapter 10; Make-or-Buy Decision at Baxter Manufacturing Company
	Second	IT Project Management	Chapter 11; Access Assignment Due
Week 13	First	IT Project Management	NIBCO's "Big Bang"
	Second	Planning the Information Systems Resources	Chapter 12; Clarion School for Boys, Inc.
Week 14	First	Leading the IS Function	Chapter 13; Meridian Hospital Systems: Deciding Which IT Company to Join
	Second	Leading the IS Function	IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 15	First	Information Security	Chapter 14
	Second	Social, Ethical, and Legal Issues	Chapter 15; Mary Morrison's Ethical Dilemma; Review session
Week 16		FINAL EXAMINATION	

Additional Course Syllabus Suggestions

The four course outlines presented here in this *Instructor's Manual* represent only four of the many possible ways in which *Managing Information Technology* can be used in an IT management course. For example, in a course with experienced managers (such as an Executive MBA Program), coverage of the early portion of the book (especially Chapters 2 and 3) could be greatly reduced to permit more time and discussion of the content in the later chapters on different types of applications and e-business opportunities. Conversely, an undergraduate course with limited prerequisites might concentrate on the early chapters and reduce further our coverage of the chapters in Part IV. In addition, different sections of Chapter 13, for example, could be covered throughout the course to help students understand the IS management issues for different case study contexts. Note that the section in Chapter 13 that presents some statistics about the IS workforce, including the skillsets needed by client organizations in the U.S. and other developed countries, can be used in conjunction with the case studies shown in the undergraduate outline: the two-part outsourcing case study as well as the short case study about an undergraduate weighing the pros and cons of working for an established firm versus a startup.

In our view, the key to a successful IT management course at all levels rests in the frequent use of real-world examples, including Web-based resources, and enhancement activities that go beyond a classroom lecture format. We believe that this particular textbook affords a special opportunity to use the **unique case studies** that have been written by the same textbook authors who have also authored the IS management chapters. In the course outlines we have emphasized case studies for the Master's course and a combination of selected case studies and computer laboratories for the undergraduate course.

However, other enhancement activities also exist, such as films, guest speakers, and technology demonstrations. If your university has an agreement with a major vendor such as SAP or Oracle, aspects of their enterprise systems can be reinforced with demos and lab exercises. We also recommend to instructors the Teradata University initiative in which a vendor is hosting an environment for students to learn more about data warehousing approaches (referred to in the two case studies on business intelligence topics). A core team of IS academics is supporting this initiative by designing exercises to work with secondary data so that students can experience what it means to work with large data sets. One of our coauthors, who also coauthored the business intelligence case at Continental Airlines in this textbook, has played a key role in the Teradata initiative.

The following pages of this manual provide teaching suggestions for each chapter and discussion questions for each case study, as well as objectives and overviews to help you select the content and assignments that best fit your own teaching needs.

Chapter 1

Managing IT in a Digital World

Objectives

Chapter 1 sets the context for studying the management of information technology in an increasingly digital world. The overall objective of this chapter is to motivate the course content. An overall theme of the text is that IT is a strategic enabler and the management of IT is a responsibility of not only IS leaders and IS specialists, but also IT-knowledgeable business managers.

Virtually all of today's students are experienced users of personal computers and handheld communications devices. Many already depend on the Web not only for information, entertainment, and perhaps shopping and online banking, but also social networking as well. Graduate students may also have already had an introduction to IS management concepts in their undergraduate programs as well as, of course, firsthand experiences with information systems designed for organizational settings.

We therefore begin the chapter with recent IT trends in computer hardware, software and networks. This sets the stage for the in-depth discussion of these IT components in the first two chapters of Part I.

The sections that follow are designed to introduce students to the roles of the IS function in organizational settings. We briefly introduce how IT is being used by organizations to lower costs as well as differentiate its product and/or service offerings. IT has also enabled new ways that people work and live, and we introduce the concepts of telecommuting and virtual teams.

Then we introduce students to three broad categories of IT resources that need to be managed in organizations, based on the three IT-asset framework of Ross et al. (1996): the technology infrastructure, the IS human resource, and the business/IT relationship. The relationship asset discussion reinforces the importance of strong working partnerships between business and IT managers—which is a core theme throughout the textbook. We also introduce here the CIO role and provide a generic organization chart to help students begin to understand the scope of the executive leadership role.

This chapter therefore sets the stage for the remainder of the text, which includes 14 subsequent chapters and supplemental case studies organized into four parts:

- Part I of this textbook focuses on fundamental concepts and terminology, as well as IT industry trends, for the basic IT components that IT-savvy business managers will need to be familiar: computer systems (hardware and software), networks, and data.
- Part II provides in-depth descriptions of three different categories of software applications used by today's organizations: enterprise systems, managerial support systems, and e-business systems that leverage the Internet.
- Part III presents methods and techniques for developing and implementing applications and managing IT projects; separate chapters are provided for basic systems concepts, custom-developed systems, purchased package solutions, and managing IT projects.
- Part IV focuses on the strategic planning of IT resources and the range of responsibilities of IS leaders, followed by separate chapters on information security practices and the broader IT-related social, ethical, and legal issues.

Teaching Suggestions

To help students understand how IT capabilities have evolved in recent decades, we have found it useful to ask students to think about how they used IT (for personal, educational, and/or professional activities) several years ago versus how they are using computers and communication networks today. If you have non-traditional undergraduate or master's students, it is possible that they may also remember pre-Internet computing solutions as well as the need to have access to land lines and hard-wired networks for communications. The textbox with “mispredictions” by IT industry leaders sheds light on the difficulties of forecasting the potential impacts of technology innovations.

For graduate-level students, we have also used the *Harvard Business Review* article by N. Carr published almost a decade ago in May 2003, which questions the value provided by IT. Its title (“IT Doesn’t Matter”) can be used to set up a debate for or against the views of Carr. [Note: The “Letters to the Editor” published in the subsequent *HBR* issue in June 2003 provide some strong alternative arguments.] Our own experience is that if the faculty member does not preempt the debate with his/her own opinions, or emphasize the perceived status of an article published in the *HBR*, the students in the class will indeed be split on the issue. As we go to press, the award-winning, partly fictional, movie on the rise of Facebook (*Social Networking*) also provides a glimpse into Web-based startups today and can also be used to help students understand the dot-com frenzy in the U.S. by the late 1990s.

One approach for motivating the technology chapters (in Part I of the text) is to split the class in half, give everyone some answer cards (e.g., A, B, and C) and then ask multiple choice questions on hardware, software, and network innovations that they may be familiar with as individuals (such as the first Web browser, Smartphones and app stores, broadband options, etc.). All students hold up their own answers, the correct answer is revealed, and those that get the answer right are the team “survivors” for the next question. The team with the most survivors at the end of the game is declared as having the most “digital literacy” or something equivalent.

News stories on IT topics and the IT industry (in print or Web-based) can also be used to help motivate the course content. Students will also be introduced to the idea that they can easily advance their IT knowledge by continuing to read articles written for a general business audience about emerging technologies and IT industry developments not only during this course, but after this course has ended. Keeping up with new IT-related business opportunities is a responsibility of every manager, both business managers and IS managers. News sites for IS managers (such as cio.com) and professional organization Web sites may also be introduced at the first class meeting as useful resources.

It is also important to emphasize how managing IT in organizations (i.e., the role of information systems departments) has become much more complex over the past decade. The description of the 3 types of IT resources can be used to emphasize the importance of not only technology and IS professional resources, but also fostering strong business/IT relationships. Another approach is for students to brainstorm about what is needed to support sales employees and other workers who are “anytime, anywhere,” to coordinate workers in widely dispersed buildings, to have the organization’s public Web site for sales and service available 24/7 (24 hours a day, 7 days a week), and to keep track of what others are posting about an organization’s products or services on social networking sites with millions of users.

The Midsouth Chamber of Commerce (A) case study that immediately follows Chapter 1 sensitizes students to what can happen when a well-meaning business manager is the champion for the purchase of an information system, but there is no formal project team for acquiring and implementing new software that affects multiple functions. Because this case takes place in a very small organization, it is easy for these management issues to be brought out—but this type of management issue is also common in other

organizations. This case can also be used to illustrate the difficulty of managing IT resources without a strong IS leadership role. The Midsouth case can also be used as a common point of reference for subsequent chapters on purchasing software packages (Chapter 10), IT project management (Chapter 11), and IS leadership responsibilities (Chapter 13).

REVIEW QUESTIONS

1. Define what is encompassed in the term *information technology*.

We define **information technology (IT)** as computer technology (hardware and software) for processing and storing information, as well as communications technology (voice and data networks) for transmitting information.

2. What are some of the ways that IT has become "pervasive"?

IT has gone beyond extending communication channels within organizations. We see online stores, Web-based customer service offerings and the like as new offerings to retain competitive advantage. We also see that with the increased ease of access to the information and enhanced communication tools, workers are less constrained with time and location in their productivity. As stated in the text, work teams may never meet face-to-face and regularly use meeting software and video conferencing. Workers may choose a BlackBerry, iPhone, or other Smartphone to access office e-mail "anytime, anywhere." Similarly, virtual teams can be formed from geographically dispersed members, now with commonly used tools for online meetings that also facilitate document sharing.

3. What kinds of portable IT help employees work more efficiently and effectively? What may interfere with productivity?

Portable computers (such as laptops and smart phones) and high speed wireless networks from public transportation, airports, and even from in-flight airplanes keep employees productive.

IT also reduces the barriers to information access as well as information creation. The challenge then becomes accessing the "right" information. Excessive amounts of information available to workers may require them to find the signal in the noise. This can be challenging, and time consuming.

4. What kinds of IT can help support teams when team members work at different locations?

Meeting software and video conferencing can support virtual teams. The most basic kind of IT for supporting virtual teams is communication technology that facilitates the transmission of information among the team members. This may include smart phones with Internet connectivity. Additionally, many organizations provide remote access to important information resources for employees in many locations. [Note: This is made possible by improvements in authentication software and other new security tools.]

5. How have some businesses used the Internet to compete based on low cost, product/service differentiation, or both?

Low Cost: The Internet can increase a company's "reach" to new customers and new suppliers, who may even be on different continents. Example: Airline companies now have a direct channel to consumers and business customers, which means they don't have to pay travel agents or online intermediaries to sell all of their tickets.

Product/Service Differentiation: Example: Amazon was one of the first to develop a different user experience as part of its service offering. Web sites can also be programmed to display screens using a different language and different currency, depending on the user's browser location or selected preferences.

Low Cost and Product/Service differentiation: Airlines and other organizations have offered cheaper pricing for online purchasing, as well as loyalty programs with rewards of different types for online customers. For manufacturing businesses with business customers, lower prices can be offered depending on the customer relationship; some customers may be offered access to the manufacturer's manufacturing quality and inventory data.

6. What kind of a business might choose to have low levels of dependence on IT?

Some organizations may still use IT primarily for back-office support but rely heavily on person-to-person communications to operate their business. Professional service organizations in particular may choose to keep their front-office person-to-person communications, and law and medical professionals may choose to have minimal usage of information technology. [Note: For paper-based physician practices in the U.S., there are federal government incentives (HITECH Act passed in 2009) to become more digitized, including electronic transmission of patient data for referrals and lab tests, etc.]

7. What three types of IT resources need to be managed well?

The textbook emphasizes three resources (based on Ross et al. 1996):

- Technology Infrastructure
- Human Resources
- Business/IT Relationships

8. What are some examples of newer IT manager roles, and why are they needed today?

CSO (Chief Security Officer): To plan for and monitor compliance with new federal laws and reporting requirements and to ensure that appropriate investments are made in technologies and procedures to manage IT security risks.

Middle Manager roles for outsourcing: To help ensure that contracts with key outsourcing suppliers have successful outcomes

9. For what reasons might an IT manager have a reporting relationship with a CIO as well as with a senior business manager?

This dual reporting relationship helps ensure that the IS department's resources are well aligned with the business; it is one approach to establishing and maintaining a strong business/IT relationship.

Discussion Questions

1. Provide an example of how a business function with which you are familiar (e.g., sales, marketing, finance, operations/production, accounting, human resources) utilizes IT for operational and/or strategic purposes.

For example, an international convenience store chain automated its in-store job applications for its HR department. An online system allows the store chain to accept job applications in the stores via kiosks that are connected to the central HR system at headquarters. The applications are then automatically routed to the responsible HR manager to review based on job openings, job descriptions and review rules set forth by the HR department.

2. Describe some ways that you personally use information technologies differently than you did just a few years ago.

A possible student answer: Smart phones and global positioning systems make travel a lot easier in unfamiliar locations. I stopped using printed maps more than a few years ago, and now don't even have to get the directions based on a starting point. Instead, with consumer electronics I can get ad hoc directions to a final destination based on my current location. I also rent all my movies online by either using streaming technology or having the DVDs mailed to me. All my personal documents are stored "in the cloud" so that they are constantly backed up, and more importantly, I can access them with multiple personal devices.

3. Some organizations purposefully select a CIO that has strong business management backgrounds, not just technical experience. Under what organizational circumstances do you think this might be an effective choice?

A CIO with a strong business management background may be a better choice for organizations where IT is beginning to be used for competitive advantage and/or the business is rapidly changing. In organizations less strategically dependent on IT, or competing in the IT industry, a leader with a strong technology background may be preferred. [Note: There are several recent articles on different types of CIO roles and factors that can influence the choice; for example, see two research articles in the March 2011 issue of *MIS Quarterly Executive*.]

4. Describe a new business for which you think a "virtual organization"—which has no physical office or headquarters—could be an effective design. What are some ways that the organization could use IT to help them effectively run their business?

Service organizations are generally the best candidates for being "virtual"—as well as smaller organizations. Video conferencing, desktop sharing and other collaboration tools can be used for synchronous communications. Web based portals with appropriate security and cloud computing options provide access to organizational data.

5. Would you like to work as a free agent? Why or why not?

Working as a free agent in the early stages of one's career is a great opportunity to learn about different organizational contexts and industries. Free agents also have greater flexibility in their choice of location since they are more likely to be telecommuting. However, as one's career develops, job security and concerns about healthcare and other employee "benefits" can take precedence.

6. Using the Internet, identify what is meant by the term *digital divide*. What actions do you think could be taken to lessen this divide—both within your own country and elsewhere in the world?

This term refers to large numbers of “have not’s” with no access to computers and modern communications. As the cost of computer hardware has decreased and wireless network access has increased, more people have access to information technologies. However, the technology with the greatest impact on the “digital divide” has been the cellular phone, including those with texting capabilities.

7. Identify some Web sites for publications that could be useful supplementary resources for studying some of the IT topics in this textbook.

<http://www.computerworld.com>

<http://www.cio.com>

<http://www.itprc.com/publications.htm>

<http://esj.com>

<http://www.b2bpublications.com>

http://www.business.com/directory/computers_and_software/computer_services/information_technology_it_services/reference/publications

<http://www.intelligentedu.com/pubs.html>

Teaching Note on Case Study 1

Midsouth Chamber of Commerce (A): The Role of the Operating Manager in Information Systems

Objectives

Midsouth Chamber of Commerce (A) is based on an actual situation with only cosmetic changes made to protect the identities of the organization and the individuals involved. This case describes the complex and often chaotic process of implementing information technology change in an organization with conflicting objectives.

The primary objective of this first case in the book is to examine the role of the business manager in the management of information technology in organizations (in this case, the implementation of a new software system).

Secondary objectives of this case include:

1. Illustrating some of the possible roles business managers may play in the implementation of information technology.
2. Demonstrating some of the pitfalls that a business manager may encounter as technology is introduced.
3. Illuminating the role of the technology provider—in this case the software vendor.
4. Revealing the importance of information systems (IS) politics.

Overview

The Midsouth Chamber of Commerce (MSCC) was a growing, aggressive, statewide chamber of commerce that had historically benefited from its strong leadership. One example of its leadership was Leon Lassiter, the Vice President of Marketing at the MSCC. Early in his tenure, Lassiter realized that the MSCC needed to acquire new software in order to provide the enhanced sales and marketing support he felt was necessary for his department and the MSCC to be truly successful. As a result, Lassiter became the champion for acquiring a new software system, in particular a system developed by the Unitrak Software Corporation simply called Unitrak. After Lassiter successfully convinced the Executive Committee of the Board of Directors to authorize the purchase, the real problems began for the MSCC.

While Lassiter had been the champion for the purchase of the software system, he was not in charge of computer operations nor was he able to garner cooperation from the main individual who was in charge, Jeff Hedges, the Vice President of Public Finance. Furthermore, the systems analyst, Simon Kovecki, proved to be a weak resource for the Chamber as he was both inexperienced and upset that he was not appointed manager of computer operations when Hedges was given the role of running the MSCC's information technology organization.

With animosity developing throughout the organization, Kovecki, in particular, pulled away from the project and provided very little support in the early stages of Unitrak's installation. Even after he became more involved, the MSCC began to experience additional technical problems that

neither Unitrak nor Kovecki could solve. And, while Unitrak did assist in the training, the firm provided very little help during the attempted data migration between the systems. So, by the time Lassiter stepped in to champion the project, he was forced to do so without the support of key players within the MSCC. As this case closed, the old system had been rendered essentially inoperative after Kovecki's failed attempt at migrating the data to the new system. As a result, the MSCC was left with no computer support for its operations, and the organization needed solutions quickly to prevent additional operations from stalling.

Questions for Discussion

1. Identify the key players in the case and describe their respective roles. Are these the right roles? What roles in particular should be modified? How might such role modifications be accomplished?

Key Players and Roles

- **Leon Lassiter—Vice President of Marketing of the MSCC.** Lassiter was a high-ranking business manager, with no information technology background, who recognized the need for a new software system at the MSCC and acted as its champion during the acquisition (and eventually the implementation) process. In his short tenure, Lassiter had proven to be a very strong marketing manager for the MSCC, but he was nevertheless unsuccessful in getting more appropriately positioned people involved in the implementation of the new software system. This forced Lassiter to serve as the champion of the project throughout the entire process—a role that he was unqualified to perform.
- **Jeff Hedges—Vice President of Public Finance of the MSCC.** Hedges was the leader of the MSCC's tiny computer operations section. Given the bulk of tasks he had before him, Hedges was not significantly involved in the new system's implementation. Generally speaking, Hedges appeared to look at his computer responsibilities at the MSCC as a secondary duty—a fear that Kovecki had when Hedges was named to this position.
- **Simon Kovecki—Systems Analyst at the MSCC.** Kovecki—a young computer science graduate with no experience in a membership organization or with administrative software—was the only IS professional inside the MSCC. Kovecki spent his first three months at the MSCC learning not only the organization but also the computing systems—without the benefit of any systems documentation. Nevertheless, Kovecki was able to have the old system running reliably. His cursory involvement during the early stages of the new system implementation process, though, got Lassiter's project off to a slow start. His lack of involvement was due to two issues—(1) Kovecki not receiving the responsibility for leading the MSCC's computer operations, and (2) Kovecki's distaste for the features of the software package chosen. Unfortunately, once Kovecki finally did become involved in the project, he was unable to make the new system operational.
- **Ed Wilson—Vice President of Public Affairs and Operations of the MSCC.** Before his reassignment, Wilson had been in charge of computer operations and had actually introduced the MSCC to the world of microcomputers and database management. While Wilson and Lassiter did not have a strong relationship at first, eventually the relationship became amicable, and Wilson provided Lassiter with some support during the Unitrak acquisition process. Overall, however, that was the extent of Wilson's involvement in this process.
- **Jack Wallingford—President of the MSCC.** While Wallingford was the President of the MSCC, his involvement in this decision and the system implementation was negligible.
- **Executive Committee of the MSCC.** While this group made the ultimate decision to purchase the Unitrak software, they did not appear to have followed up on this purchase

during the implementation process. Additionally, their decision to support the Unitrak system may have been too quick and based too much on Lassiter's input instead of the due diligence one would expect from this group.

- **Greg Ginder—President of Unitrak Software Corporation.** Ginder made considerable concessions in order to sell his company's software to the MSCC including unlimited support during the system installation. Nevertheless, when the MSCC needed Unitrak the most—during the system migration and conversion process—Unitrak's support was missing or ineffective.

Role Modification

Clearly several of the roles discussed above should have been modified. Neither Hedges nor Kovecki—the two most important IS players at the MSCC—were meeting their job responsibilities, and Lassiter proved inept at gaining their cooperation or improving their effort level. At the same time, Wallingford and the Executive Committee should not have remained aloof in the face of the crisis that was upon the MSCC and could have played a larger role in getting Hedges and Kovecki's attention. Furthermore, while Ginder did provide some support for the MSCC, it was not at the level or in the amount that a reputable software vendor should provide.

How to implement these role modifications is a more difficult question. Hedges or Kovecki may not have had the expertise to perform their job descriptions and may have simply needed to be replaced. Generally, however, Lassiter did a poor job of playing IS politics and may have been able to avoid this entire situation by doing a better job with IS politics. As an example, as mentioned above, Lassiter could have gone to Wallingford to request help in garnering the support of Hedges and Kovecki. Furthermore, depending upon the software contract, Ginder's support might have been more forthcoming during the critical stages of implementation had legal action been threatened.

2. Focus on the role of the software vendor—Unitrak Software Corporation. Was it an appropriate role? Did Unitrak act responsibly?

This question was partially answered in question 1 above. Unitrak certainly did not act responsibly during this entire scenario. Whether Unitrak was legally at fault depends upon the terms of the software contract, which were not presented in the case. It is reasonable to assume, however, that such a contract would have included specific assurances for Unitrak to meet that would include an operational system—something the MSCC did not have when this case closed. One would hope that Ginder's promise to provide "unlimited support at no charge to install the system" would have been in that list of assurances/warranties. If so, Unitrak would have opened itself up to legal action.

Furthermore, when the MSCC was at a critical phase—the data migration step—Unitrak was "missing in action." For a company that had a stated goal of penetrating the chamber of commerce market, this act appears to be working against its own interests. While neglecting any customer is a sign of concern, neglecting a key component for a company's business growth and development is that much more inexcusable.

3. How much is Kovecki to blame for this situation?

While most students tend to put much of the blame on Lassiter, Kovecki is also a key component to this problem. Clearly company politics played some role, but Kovecki failed to perform some

of the basic pieces of his own job description by, as one example, failing to provide support in the early stages of this process. From a technical standpoint, too, one would never migrate data on a system without first performing a system backup—a move that Kovecki failed to make. This failure has to make one question whether Kovecki's technical skills were as strong as they may have at first appeared. When coupled with the high likelihood that the software had a serious internal problem, however, Kovecki was in a no-win situation by the time the data migration occurred. One could argue, however, that he had placed himself in that position by failing to be more involved in the process from the beginning.

Nevertheless, politics played a significant role in this scenario, as Lassiter and Kovecki needed to work closely during this process and that was not possible due to the animosity that had built up between them and between Kovecki and the organization—because he had been passed over for a position that he was clearly more qualified to perform than the person given the job. As Kovecki pulled away from his position and the MSCC, the organization's IS began to fall apart.

4. One of the recurring themes of this book is the importance of information systems politics. To what extent does IS politics explain the situation that has developed at the Midsouth Chamber of Commerce?

IS politics helps explain much of the MSCC's situation. The new system was Lassiter's idea, and he was unable to "sell" the system to either Hedges or Kovecki, the two people who were critical to the system's ultimate success. As such, Lassiter went over these individuals' heads, and the system became Lassiter's system, not their system, or even the MSCC's system.

Furthermore, when Lassiter initially proposed the new system to the Executive Committee, it was pushed through, but likely as the result of respect for Lassiter rather than because of reasonable due diligence. After the project did not make progress for a few weeks, Lassiter began to ask questions. Hedges then told him to simply push the project through himself because it was "his project." As he did so, several staff members expressed concern that they had not been consulted or informed of the idea before its approval. And as a result, with no one having ownership of the system and no buy-in from any of the other executives in the MSCC, the animosity level rose and the excitement about the new system was drowned out by it.

5. The case involves what appears to be a fairly routine use of information technology to support a service organization. Yet the Midsouth Chamber of Commerce encountered major problems in bringing up its new system. Is there a lesson here for organizations seeking to adopt new information technology? What is it?

What appears to be a routine application of information technology to an organization with an experienced, knowledgeable IS staff may be anything but routine to an organization lacking IS skills in its business managers. Certainly there is no way that the MSCC could have successfully adopted truly new information technology with its current level of internal IS knowledge and its apparent unwillingness to find that knowledge outside the company. By placing control of the information technology with someone who had little information technology background and was managing the process "on the side," the MSCC lessened the opportunity for its information technology to provide a competitive advantage for this organization.

Therefore, the lesson to be learned from this case is that organizations should honestly and carefully consider whether they have a sufficient level of expertise before attempting to adopt new technology. Furthermore, an organization must have "buy-in" from all its executives before

making such a purchase. Even if a system works perfectly from a technical perspective, it will never reach its potential if management is not advocating its use throughout the organization.

6. What should Lassiter do now?

Lassiter must immediately focus on making the conversion process work. With both the new and the old systems down, Lassiter has two choices: outsource the MSCC's IT needs to an outside vendor or create an ad hoc paper system in the interim. A paper system is likely not going to work for long. At the same time, it will take Kovecki (or his replacement if fired) time to get the system up and running without help or viable documentation. As a result, Lassiter must also look outside the company to find Kovecki some additional help—perhaps from another company that uses and/or has had some experience with the Unitrak system.

Finally, Lassiter needs to pull the entire management team together, explain the situation, and reintegrate them by inquiring about suggestions on how to proceed. He also needs to ask them to inform their staff of the situation and the steps being taken to correct the situation. By doing this the staff might become less disgruntled with the system's inoperativity in the short term.

Chapter 2

Computer Systems

Objectives and Overview

Chapter 2 is the first of a trio of chapters devoted to the primary building blocks of information technology. Chapter 2 concentrates on computer systems, including both the **hardware**—the physical pieces of a computer system—and the **software**—the set of programs that controls the operations of the computer system. Chapter 3 covers telecommunications and networking, and Chapter 4 explores the data resource that is manipulated by the hardware, software, and telecommunications. These three chapters constitute the “hard-core” technology portion of this textbook. We believe that every information systems or information technology course using this textbook should incorporate these three chapters, covered in sequential order, *unless* the students already have strong technology backgrounds. The amount of time spent on these chapters will vary considerably, of course, depending upon the level and purpose of the course. Alternative approaches to using Chapter 2 are discussed in the “Teaching Suggestions” section below.

Chapter 2 in the Seventh Edition is a brand new chapter, incorporating (in greatly reduced form) the material that was covered in Chapter 2, Computer Hardware, and Chapter 3, Computer Software, in the Sixth Edition of this book. The primary objective of Chapter 2 is to provide the student with a basic understanding of computer systems—both the hardware and the software. The goal of the chapter, simply stated, is to let the reader know what he or she needs to know about computer systems *and no more*. Managers need to understand the major ideas involved in computer systems, and they need to know the important terminology and concepts. Chapter 2 is aimed at satisfying this “need to know” in a straightforward, understandable way.

It may be useful to view this chapter as consisting of five major sections—two of these are primarily devoted to computer hardware, two more are primarily devoted to computer software, and the fifth section is devoted to the information technology (IT) industry. The first major section provides an extended discussion of the *underlying structure of computer systems*, including the stored-program concept. This section will be largely review for those students who have significant practical computing experience (more than just word processing and spreadsheets) or those who have had previous courses in computer programming or information technology. The second major section describes the *categories of computers* in use today, including information about the hardware component of the information systems industry. This material will be new for most students and should provide a useful current perspective for everyone.

After a short introduction to the two key types of software—applications software and support software, the third major section on *applications software* includes an example of an application package that might be purchased as well as an extensive treatment of personal productivity software (word processing, spreadsheets, database management systems, Web browsers, application suites, and so on). This section will be largely review for students with practical computing experience or previous courses in programming or IT. The fourth major section, which deals with *support software*, covers the all-important operating system, the wide variety of programming languages, database management systems, CASE tools, and communications interface software. We suspect this section will be mostly new for students unless they have an extremely strong computing background. After a short section on the

changing nature of software, the fifth major section discusses the information technology industry. This section should provide a good overview of the IT industry for all students, regardless of their background. As mentioned above, all of these sections have been significantly revised and reduced in the Seventh Edition.

What are the highlights of this totally new chapter? In terms of hardware, the “categories of computers” section has been extensively reworked to include new boundaries between the categories as well as updated lists of the major vendors in each category. The boxes on blade servers and Smartphone’s present new hardware developments. In terms of software, major story lines include the continued growth of open source software, especially the Linux operating system; the growth in the use of XML, eXtensible Markup Language; and the continuing debate over the relative merits of the J2EE and .NET frameworks for developing applications on the Web. The short IT industry section at the end of the chapter provides a fairly concise overview of the industry while identifying the major players in each segment of the industry.

The specific objectives of this chapter are:

1. To outline the underlying structure of all digital computers, including input, output, memory, arithmetic/logical unit, control unit, and files.
2. To describe the all-important stored-program concept, which is the basis for the way in which all computers operate today.
3. To describe the different categories of computers, including microcomputers, midrange systems, mainframes, and supercomputers, and to identify the major hardware manufacturers in each category.
4. To distinguish between applications software and support software.
5. To introduce the idea of purchased applications packages.
6. To consider the variety of personal productivity software packages—such as word processing, spreadsheets, and presentation graphics—that are likely to be used by managers on a regular basis.
7. To consider the wide variety of functions accomplished by the operating system and to describe the other types of support software, including language translators, database management systems, communications interface software, CASE tools, and utility programs.
8. To consider the makeup and changing composition of the different components of the information technology (IT) industry.

The difficulty in teaching Chapter 2 lies in correctly assessing the computer systems background of the majority of the class and adjusting classroom time and material accordingly. Most of today’s students understand microcomputers and the role of personal productivity software packages, and they know a little about the Windows operating system. However, unless they have an excellent computing background (either through work or coursework), they are unlikely to know much about types of computers other than microcomputers, about support software, or about the IT industry beyond Microsoft. We have found, to our dismay, that many students who have had a computer tools and/or computer programming course do not really comprehend the important difference between applications software and support software, and thus we suggest stressing this key idea.

Our suggestion is to tell the students, in advance, that some of the material may be review for them, and that they may skim subsections with which they are familiar. Furthermore, tell the students that they should not be concerned with the mechanical details of the sample programs given in the text—these samples are provided merely to give students the flavor of the various languages. At the same time point out that the totality of this chapter should provide them with an extremely valuable overall perspective on computer systems. With such an advance warning, we think most students will react favorably to this chapter. Students without a strong background should appreciate the chapter’s clear organization and

extensive descriptions, while those with stronger backgrounds should find that the chapter provides a useful review and synthesis.

Teaching Suggestions

The primary difficulty in teaching this chapter lies in correctly assessing the level of computing knowledge of a given class and adjusting the classroom sessions accordingly. It is important to neither undershoot nor overshoot the majority of the audience. On the other hand, don't attempt to cater to the few students who have an excellent computing background, or to the few who know nothing at all about computers.

For most courses using this textbook, we believe that you should allot from two to four 75-minute classroom sessions to Chapter 2 and related enrichment activities. For courses where most students have a *good* computing background, two sessions should suffice. We would suggest using about half of one class period giving a “mini-lecture” on the hardware portion of Chapter 2, making sure that students understand the underlying structure of all computer systems, the stored-program concept, and the roles of the different types of computers in use today. On this latter topic (the roles of different types of computers), enliven the discussion by bringing in very recent statistics or news clippings describing recent events in the rapidly changing hardware industry (Which vendor is leading in server sales? Which smartphone is in the lead in terms of business use? What is currently the world's fastest supercomputer?). In the latter half of the class period, employ an enrichment activity related to computer hardware or computer use in general. For example, if you haven't already used Case Study 1, Midsouth Chamber of Commerce (A): The Role of the Operating Manager in Information Systems, this would be a good time to use it. Alternatively, Case Study I-1, IMT Custom Machine Company, Inc.: Selection of an Information Technology Platform, deals with the hardware platform selection for a manufacturing company. Teaching notes for both of the case studies are included in this *Instructor's Manual*. As another enrichment activity, you may be able to locate one or more video presentations on the Web sites of hardware vendors that describe the features of the vendors' newest large computer systems, and then you can play one or more of these video presentations during the class period. Today's students tend to be quite familiar with microcomputers, but may never have seen any larger machines. Don't overdo the use of such advertising vehicles, but ten to fifteen minutes may provide an interesting and educational interlude in a long classroom session.

For the second classroom session for a course in which most students have a good computing background, we suggest concentrating on computer software, the IT industry, and a related enrichment activity. Again, we suggest using about half of the class period giving a “mini-lecture” on the software portion of the chapter and the IT industry section, making sure that students understand the difference between applications software and support software; the roles of the operating system and other support software; and the notions of fourth generation languages (4 GLs), eXtensible Markup Language, object-oriented programming, and Web programming. Don't attempt to cover all the details of these programming sections; concentrate on the big picture. In the IT industry discussion, start with the analysis provided in the chapter, but update it with developments in the months since the chapter was written. In the latter half of the class period, employ an enrichment activity such as the new Case Study I-6, HH Gregg: Deciding on a New Information Technology Platform (a teaching note for this case study is included in this *Instructor's Manual*). A second type of enrichment activity is to demonstrate a software package that most of your students will not know, such as the Adobe Systems PageMaker desktop publishing package. Plan the demonstration carefully and avoid covering excessive detail. In summary, we suggest allotting two 75-minute classroom sessions to Chapter 2 in those courses where most students have a good computing background.

In a course in which most students *do not* have a good computing background—for example, an advanced undergraduate course where the students have had only a single computer tools course (e.g., Microsoft PowerPoint, Microsoft Excel, Microsoft Access)—we believe that you might need four 75-minute sessions to cover Chapter 2—two of these sessions on computer hardware and two on computer software and the IT industry. For the first session, we suggest a traditional lecture-discussion approach to cover the computer hardware portion of the chapter, making sure that students understand the underlying structure of all computer systems, the stored-program concept, and the roles of the different types of computers in use today. Use PowerPoint slides of your own, slides taken from the book’s Web site, or slides made from the figures or tables in the text. As suggested above, enliven the latter part of this discussion by bringing in very recent statistics or news clippings describing recent events in the rapidly changing hardware industry (Which vendor is leading in server sales? Which smartphone is in the lead in terms of business use? What is currently the world’s fastest supercomputer?). Don’t get too deeply into the details; remember that our goal is to cover what managers need to know.

For the second session, devote the entire class session to one or more enrichment activities. Three options were mentioned above: Case Study 1, Midsouth Chamber of Commerce (A): The Role of the Operating Manager in Information Systems; Case Study I-1, IMT Custom Machine Company, Inc.: Selection of an Information Technology Platform; or video presentations about large computers from a computer vendor’s Web site. Another idea is to devote this second session to a different type of enrichment activity—bring in an old desktop PC and take it apart in front of the students. Take off the cover, and take out (one at a time) the microprocessor chip, the hard drive, the floppy drive, a memory chip, the modem, the network interface card, and any other easily removable parts (DO NOT do anything with the power supply), and pass them around to the class. Of course, get an old PC well ahead of time and practice taking it apart, including opening up the hard drive so that the students can see the disk.

For the third session, we suggest a traditional lecture-discussion approach to cover the computer software and IT industry portions of the chapter. Make sure that students understand the difference between applications software and support software; that they understand the roles of the operating system and other support software; and that they understand the notions of fourth generation languages (4 GLs), eXtensible Markup Language, object-oriented programming, and Web programming. Don’t attempt to cover all the details of these programming sections; concentrate on the big picture. In the IT industry discussion, start with the analysis provided in the chapter, but update it with developments in the months since the chapter was written. Again, use PowerPoint slides of your own, slides taken from the book’s Web site, or slides made from the figures or tables in the text. You will certainly have more time to cover the material here than in the “mini-lecture” suggested above for the two-class-session approach to this chapter, but avoid the temptation to build in too many details; stick to the basic concepts.

For the fourth session, we again suggest devoting the entire class session to one or more enrichment activities. Two options mentioned above were Case Study I-6, HH Gregg: Deciding on a New Information Technology Platform, and the demonstration of a software package that most of your students will not know, such as the Adobe Systems PageMaker desktop publishing package. A third enrichment activity is to locate a software company’s Web site that contains one or more video presentations about their software products, and then play one or more of these video presentations during the class period. A somewhat similar fourth enrichment activity is to have a representative of a software vendor (which certainly might include major hardware vendors like IBM and Hewlett-Packard) speak to the class and describe some of the vendor’s recent software offerings.

Of course, these two options—two-session coverage of this chapter and four-session coverage of this chapter—are only two of the many options. If your class, on average, has an *excellent* computer background, you may choose not to cover the chapter at all in class, but rather suggest that your students

read the chapter as background reading. Even in this case, we would urge you to employ one of the above-mentioned case studies in a class session to get your students thinking about IT platforms and the role of a manager in dealing with IT. For some courses, a three-session approach to covering this chapter may be appropriate. Most likely, this would involve a lecture-discussion approach to the computer hardware material in one class session; a lecture-discussion approach to the computer software and IT industry material in the second class session; and some combination of one or more enrichment activities in the third class session.

Let us repeat a final bit of advice on teaching this chapter and the other technology chapters: Don't attempt to cover all the details that are embedded in these chapters. Let the chapter speak for itself, and take advantage of the fact that students will know some of this material before taking your course. You should concentrate on making sure that students understand the important concepts and terminology involved with computer systems, and that they appreciate the roles played by the different types of hardware and software.

Review Questions

1. Distinguish between microcomputers, midrange systems, mainframes, and supercomputers. Give approximate speeds (millions of floating point operations per second, or MFLOPS) and costs.

Microcomputers, or PCs, may be desktops, notebooks, or palmtops. They are used for personal computing, Web clients, clients in client/server applications, and small business processing. MFLOPS range from 500 to 5,000. They cost from under \$200 to \$4,000.

Midrange systems are used for departmental computing and for specific applications such as office automation and computer-aided design. They are servers in client/server applications and are used for midsized business processing and by universities; they also function as Web servers, file servers, and local area network servers. MFLOPS range from 2,500 to 250,000. They cost from \$4,000 to \$1,000,000.

Mainframes can handle thousands of terminals and can operate as very large servers, including as Web servers. They are used for large business general processing and can handle the widest range of applications. The MFLOPS are from 2,500 to 1,000,000. They cost from \$500,000 to \$20,000,000.

Supercomputers handle numerically intensive scientific calculations; they can also operate as very large Web servers. The MFLOPS are from 250,000 to over 3,000,000,000. They cost \$1 million to \$100 million.

2. List the six building blocks that make up digital computers, and describe the flows of data that occur among these blocks.

The six building blocks are input, output, memory, arithmetic/logical unit, control unit, and files. Data flows from input to memory; from memory to the control unit; from memory to and from files and the arithmetic/logical unit; and from memory to output. Data flows are always to or from memory.

3. What are the advantages and disadvantages of using direct access files versus using sequential access files? Why do organizations bother to use sequential access files today?

Sequential access files are organized in order according to the control key of each file. Because there are no addresses in a sequential access file, the only way the computer can find a specific record is to start at

the beginning of the file and read each record until it reaches the desired one. If retrieval time is an important consideration, sequential access files may not be practical. However, huge quantities of data can be stored very economically using sequential access files. Therefore, if retrieval time is *not* an important consideration—such as for batch processing and little-used archives—then sequential access files are an attractive choice.

When using direct access files, the computer can retrieve a specific record immediately by going directly to the file address to find the record. The advantage of using direct access files is the speed of access and retrieval. This is especially important for online systems. For applications that are batched and where response time is not critical, sequential access files may be more economical. The main challenge in using direct access files is translating the identification number for a record into an address. This translation requires highly sophisticated software.

4. Explain in your own words the importance of the stored-program concept. Include the role of the control unit in your explanation.

A stored program consists of a set of operating instructions that provides a precise listing of exactly what the computer is to do, prepared in a form that the control unit of the computer has been built to understand. Most importantly, the control unit carries out these instructions at *electronic speed* rather than waiting for humans to tell it what to do next. Because each computer model differs, the “language” in which programs are written will differ from one computer model to the next.

After the entire machine language program has been prepared, it must be stored in the computer’s memory. The control unit then is told (somehow) where to find the first instruction in the program, and this instruction is brought into the control unit. After the first instruction has been interpreted and carried out by the control unit, the control unit fetches the second instruction from memory. The control unit then interprets this second instruction and executes it. The control unit then fetches and executes the third instruction. The control unit proceeds with this fetch—execute cycle until the program has been completed. The important point is that the control unit is fetching and executing at electronic speed; it is doing exactly what the programmer told it to do, but at its own rate of speed.

5. What is a blade server and why have blade servers become important in the last few years?

A blade server (also referred to as a blade) is a very narrow, compact server that can be placed into a blade server chassis along with several other blade servers. For example, one variation of a blade server is 1.2 inches wide and about 15 inches tall; 14 of these blade servers can be mounted in a single chassis—they slide in much like sliding a book into a bookshelf. The chassis supplies the power supply for the blades, the management system, and the network switch; each blade server has its own processor, memory, and hard drive.

Blade servers are important because they save space in the computing center, they reduce the required cabling, and they improve system management. Blade servers save space, time, and money.

6. Four categories of computer systems were considered in this chapter: microcomputers, midrange systems, mainframes, and supercomputers. Provide the name of at least one prominent vendor in each of these categories (and you can use IBM only once!).

Microcomputers:	Acer, Apple, Dell, Fujitsu, Hewlett-Packard, Lenovo, Sony, Toshiba
Midrange systems:	Dell, Fujitsu, Hewlett-Packard, IBM, Sun Microsystems

Mainframes:	Fujitsu, IBM, Unisys
Supercomputers:	Cray Inc., Fujitsu, Hewlett-Packard, Hitachi, IBM, NEC, Silicon Graphics International, Sun Microsystems

7. Briefly describe the four generations of computer programming languages, concentrating on the major differences among the generations. How does object-oriented programming fit into these generations? How does HTML fit into these generations?

The first generation language (1 GL) is machine language that the specific computer model is built to understand. A machine language instruction consists of an operation code and one or more addresses. The second generation language (2 GL) is assembly language, in which machine language codes and addresses are replaced by easily remembered mnemonic codes and symbolic addresses. The assembly language program is the source program, and a program called an assembler translates the source program into the machine language program or object program, which the computer can then directly execute.

Third generation languages (3 GLs) are procedural languages that are compatible across computer models. Each 3 GL instruction is translated into an average of about ten 1 GL instructions. The programmer devises step-by-step procedures and expresses them in 3 GL statements. Fourth generation languages (4 GLs) are called productivity languages and nonprocedural languages because they are easier to use. The programmer gives a precise statement of what is to be accomplished. The programmer does not need to write it in sequential order or write how to do it. Each 4 GL statement is translated into up to 100 1 GL instructions. Therefore, 4 GL programs are easier to write, modify, read, and understand.

Object-oriented (O-O) programming languages are similar to 3 GLs and 4 GLs—they are really a cross between a 3 GL and a 4 GL. O-O languages consist of embedding procedures called methods into objects and then integrating these objects into a program. Creating the objects in OOP is somewhat akin to 3 GL programming in that the procedures (called methods) are embedded in the objects, while putting the objects together to create an application is much closer to the use of a 4 GL.

HTML is Hypertext Markup Language, used to create World Wide Web pages. HTML consists of codes inserted in text to indicate headings, bold and italic text, images, and links to other Web pages. HTML is a coding language that is used to devise a Web page rather than a programming language in the sense of 3 GLs and 4 GLs.

8. List at least five categories of personal productivity software packages. Then concentrate on one of these categories, and describe a representative product in that category with which you are somewhat familiar. Provide both strong points and weak points of the particular product.

Personal productivity software includes presentation graphics, word processing, spreadsheet, database management, electronic mail, and calendaring and scheduling programs.

A presentation graphics product is Microsoft PowerPoint. It is easy to use and provides customized options. Its clip art and background options are somewhat limited, but getting better.

A word processing product is Microsoft Word. It underlines misspelled words and grammatical errors, it allows for easy formatting changes, and it allows importing of spreadsheets and graphics. It automatically changes lower case to upper case letters at the beginning of sentences. Microsoft Word is not good at correctly identifying grammatical errors in complex sentences. When trying to modify an existing document, it is sometimes difficult to modify unwanted formatting.

A spreadsheet program is Microsoft Excel. Formulas provide shortcut calculations. The user can calculate hypothetical projections easily with formula changes for easy sensitivity analysis. The user needs to understand how to set parameters and other features for a reduction in error rates.

Database management includes Microsoft Access. Access is an easy-to-use relational database, but it is limited in the size and complexity of database that it can handle.

Electronic mail includes Lotus Notes. Lotus Notes e-mail is part of a comprehensive groupware package that allows enterprise-wide communication. Many of the features of Lotus Notes are difficult for the beginner to pick up.

9. List the six major categories of support software.

Support software includes language translators, database management systems, CASE tools, communications interface software, utility programs, and the operating system.

10. What are the primary advantages of a fourth generation language over a third generation language? What are the primary disadvantages?

A 4 GL program requires fewer instructions than an equivalent 3 GL program, and—once the user knows the 4 GL language—a 4 GL program is easier to write, easier to modify, easier to read and understand, and less error-prone than a 3 GL program. The use of a 4 GL decreases systems development backlogs because less time is required to program in a 4 GL than a 3 GL. Some 4 GLs are not general purpose languages, so they have more limited usefulness. Most 4 GL programs take longer to execute than 3 GL programs because 4 GLs translate into much longer machine language programs. So, 4 GLs optimize programmer time, and 3 GLs optimize computer processing time.

11. What are the primary characteristics of an object-oriented language? How does an object-oriented language differ from a third generation language or a fourth generation language?

OOP provides the advantages of encapsulation, which protects the integrity of each object, and inheritance, which enables the creation of subclasses and superclasses from classes. OOP is similar to a 3 GL in that methods are embedded in objects, and these methods are quite similar to 3 GL programming. OOP has some similarities to a 4 GL in that programming pieces (objects) are integrated into an application. OOP requires a graphical user interface, as well as more computing power than a 3 GL or 4 GL. OOP provides increased productivity, maintainability, and paradigm consistency because codes can be reused.

12. For what does the CASE acronym stand? In general, what is the purpose of CASE tools? What types of individuals are most likely to use CASE tools?

CASE stands for computer-aided software engineering and is a collection of software tools that help to automate the software development life cycle. Systems analysts and programmers use CASE tools to specify program requirements, create data flow diagrams, and produce programming code from these high-level specifications. CASE changes the jobs of programmers and analysts by helping with the detailed work, allowing them to spend more time up-front defining the problem and what the system is supposed to do.

13. List at least three independent software houses (not associated with a computer vendor) that are major players in the software component of the information systems industry. List any software products that you regularly use and indicate the firm that developed each product.

Microsoft, Oracle, SAP, Computer Associates, and Adobe Systems are major independent software houses. Many students regularly use Microsoft Office Suite products, including Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Outlook, and Microsoft Access. Other popular software products are Microsoft Windows, Mozilla Firefox, Corel WordPerfect, Lotus Notes, Adobe Acrobat, and Adobe Creative Suite.

14. Provide the full names for the following acronyms or abbreviations used in this chapter.

OCR:	optical character recognition, an input method that directly scans typed, printed, or hand-printed material
CPU:	central processing unit, which includes the control unit and the arithmetic/logical unit
MFLOPS:	millions of floating point operations per second, a rating derived by running a set of programs in a specific language on various computers to analyze relative performance speed
UPC:	Universal Product Code, a bar code language, used widely by groceries, that enables accurate, fast input by scanning the bar code into a terminal
DASD:	direct access storage device, often a rotating disk or stack of disks that enables direct access to files; could also be flash memory
DVD:	digital video disk or digital versatile disk, a newer type of CD that holds several gigabytes of data; some of these are rewritable
DBMS:	database management system, a type of support software that is used to store, modify, and manage data and to make that data accessible in a variety of meaningful and authorized ways
JCL:	job control language, a special language to communicate instructions to an operating system
HTML:	Hypertext Markup Language, a specialized language to “mark up” pages to be viewed on the World Wide Web, indicating how the pages are to look as well as indicate links to other pages
OOP:	object-oriented programming, a type of computer programming based on the creation and use of a set of objects and the development of relationships among the objects
4 GL:	fourth generation language, a computer language in which the user gives a precise statement of what is to be accomplished, not how to do it.
CASE:	computer-aided software engineering, a set of integrated software tools used by IS specialists to automate some or all phases of a systems development life cycle process

Discussion Questions

1. Some commentators have suggested that mainframe computer systems could be squeezed out of

existence in the next few years, with the incredible advances in the capabilities of midrange systems and the power of supercomputers combining to divide up the present mainframe market. What do you think? Why?

Perhaps the most important thing to say is that the boundaries between midrange systems and mainframes, between mainframes and supercomputers, and even between midrange systems and supercomputers, are becoming more and more blurred. All three categories of machines are evolving. The most likely scenario is that, through evolution, mainframes will continue to be important because of their versatility, reliability, stability, throughput capabilities, and incredible array of already-developed software applications. Mainframes will change and evolve, but they are not going to go away.

2. What are the advantages and limitations of palmtop or handheld computers (including smartphones)? Do you have one? If so, for what do you use it? If not, what features would be particularly attractive to you?

Advantages include increased mobility and reduced cost—convenience at a reasonable cost. Limitations include the difficulty of inputting much data and displaying significant output; handheld computers are simply not convenient platforms for doing extensive computing work. The recent development of smartphones has added to the attractiveness of palmtop/handheld computers—they now combine computer capabilities with a telephone, Internet access (and therefore e-mail), a camera, and an MP3 player. Of course, these additional features have increased the cost.

3. What are the advantages and limitations of a tablet PC? Do you believe tablet PCs will be successful? Why or why not? Do you see yourself using a tablet PC in a few years?

The answer to this question became more complex when the Apple iPad was introduced in April 2010. Until that time, the major advantage for tablet PCs was that handwritten notes could be directly stored in the computer's memory in digital form such that they could be recalled and modified as desired. Otherwise, these full-function tablet PCs acted like any other PC. For these tablet PCs, the limitations were that the tablet PC was somewhat heavier and more awkward to use than a notepad and pen or pencil, and that writing on the tablet PC surface took some getting used to on the part of the user. A tablet PC is an unfamiliar medium for note-taking, but one that makes it easier to store and further process these notes. For these full-function tablet PCs, commentators felt that the devices would be successful, but only in a niche market made up of persons who take lots of notes and who are technologically inclined.

Apple's introduction of the iPad, which does *not* have the capability of reading handwritten notes or the full functionality of other tablet PCs, changed all that. The iPad is economical and is an excellent platform for viewing movies or TV shows, listening to music, reading a book, or browsing the Web. This smaller, less capable tablet PC, has caught on in a major way, not as a replacement for desktop, laptop, or handheld PCs, but as a new type of consumer device that happens to be a tablet PC. Our guess is that most students do see themselves as using an "iPad" type of tablet PC in a few years if they aren't already doing so, but students will have to answer for themselves as to whether they are likely to use a more capable tablet PC (such as the one pictured in Figure 2.5 in the text) in a few years.

4. With one firm (IBM) dominating the mainframe hardware market in the United States since its inception, and with that same firm currently near the top in every segment of the hardware industry (except microcomputers), has the computer hardware industry truly been competitive over the past five decades? Support your position.

One answer: The computer market has been competitive although perhaps not to the extent it would have been if IBM controlled a smaller share of the market. IBM's size has allowed it to devote significant

resources to R&D, enabling the company to develop more new technology than its competitors. Every year, IBM registers more patents than any other IT company—usually by a wide margin. However, the development of microprocessor chips and the commoditization of the microcomputer (PC) have changed the competitive balance in every part of the hardware market except mainframes, where IBM still dominates. IBM is a major competitor in the midrange systems and supercomputer markets, but is not truly dominant; IBM could still be a major competitor in the PC market, but it opted to exit the market because of the low profit margins. In the IT industry, software applications and computer services are the real revenue and profit generators today. IBM is the second largest software company in the world today (behind only Microsoft), and it ranks first in the computer services arena. Despite IBM's size and success, the computer hardware industry has been quite competitive over the past five decades—perhaps not as much as it would have been with multiple large firms—as evidenced by the incredible advances in computer speed and power and the incredible growth of computer applications.

5. List possible uses of a supercomputer in a business setting.

Industries using supercomputers include aerospace, automotive, chemical and pharmaceutical, general manufacturing, petroleum, and energy, in addition to the government. Supercomputers are used extensively in research and development in order to cut costs and time. Simulations of design and fabrication help analyze value-added activities. Complex simulations that would take weeks on smaller computers take hours on supercomputers. Three-dimensional analysis over time represents such complex modeling that a supercomputer is needed. Supercomputers are sometimes used as very large Web servers.

6. For most business information processing, what do you believe are the critical or limiting characteristics of today's computing systems—CPU speed, memory capacity, DASD capacity, internal communication speed, input-output speed, other factors, or some combination of these factors? Justify your answer.

Different factors or combinations of factors limit different types of application systems. For example, expert systems and artificial intelligence are limited by CPU speed. Many online database-intensive applications (like ATMs or reservation systems) are limited by the speed of transferring data to/from secondary storage (internal communication speed). For users of microcomputers, limiting factors may be memory, disk capacity, output speed, or rarely CPU speed.

7. Which one category of personal productivity software is of most value to you now as a student? Why? Within this category, what is your favorite software package? Why? Do you think that the one category of personal productivity software of most value to you will change as you move into your career? Why?

One possible answer to the first part of the question: Word processing is most important now because I continually write reports, outlines, and class notes. I use Microsoft Word because there is easy compatibility between the version I have at home and the version available in the laboratories on campus. Microsoft Word offers all of the customized options I need.

One possible answer to the second part of the question: I intend to become a financial analyst in my career, so I expect to make extensive use of a spreadsheet package in my job. I will use whatever spreadsheet package is the standard within my company, which is most likely to be Microsoft Excel.

Another possible answer to the second part of the question: I will be joining the family business (a small business), and I expect to create databases to capture the extensive data already generated in the business, then to use these databases to analyze various aspects of the business in order to present useful reports to

those running the business. The family business does not use a database management system now, so I expect to use Microsoft Access as the DBMS.

8. In the 1980s, a movement developed within the information systems industry to “stamp out COBOL” and replace it with 4 GLs and other productivity tools. Manifestations of this movement included the slogan to “Kill the COBOL programmer” (not literally, of course) and T-shirts bearing the word COBOL within the international symbol for not permitted (a red circle with a red line diagonally across the word COBOL). Do you think the movement will ever be successful? Why?

COBOL has proved its usefulness as a procedural language and is still important. COBOL is widely used and relatively easy to learn; the majority of business applications on mainframe computers still employ COBOL programming. COBOL offers the advantage of machine efficiency because COBOL programs take less time to execute than 4 GL programs or object-oriented programs. COBOL is used in many production programs that are run daily, and it will continue to be used for the foreseeable future for most of these production programs. While it is true that most new development today does not employ COBOL, there is still a demand for COBOL programmers to modify and enhance existing COBOL applications. Though the importance of COBOL is likely to continue to decline, the development of new versions of COBOL, including an object-oriented version, ensures its use into the foreseeable future.

9. You have probably had experience with at least one procedural (3 GL) language in either high school or college. What are the strengths and weaknesses of the particular language that you know best? Based on what you have gleaned from the text, what primary advantages would a nonprocedural 4 GL offer over the 3 GL that you know best? What disadvantages?

One possible answer: The 3 GL I am most familiar with is COBOL. The strengths of COBOL are that it is a very logical language, it is exact and precise, and it is fairly easy to understand. The weaknesses are that COBOL is very verbose, it is time consuming to write instructions, and if even one comma or space is incorrect the entire program will not run. When a program will not run it may be difficult to find the error.

A nonprocedural 4 GL would be better than COBOL because the programmer simply has to tell the computer what is to be accomplished, not how to accomplish it. A lot of hassle regarding syntax would be eliminated. However, a disadvantage is that the user might be able to write a 4 GL program without really understanding the problem, and thus the resulting program doesn't really do what it needs to do. When using COBOL, it is necessary to thoroughly understand and define the problem before writing the program. Generally speaking, though, a 4 GL program will be easier to write, easier to modify, easier to read and understand, and less error-prone than COBOL.

10. The box entitled “J2EE Versus .NET” introduced the differences between these two competing frameworks for developing Web applications. Explore J2EE and .NET in more detail by discussing the two frameworks with programmers you know and by conducting research using the Web. Are there other differences between the two frameworks? How would you modify the conclusions provided in the “J2EE Versus .NET” box?

This is obviously an open-ended question, and there are certainly many differences between the two frameworks in addition to those mentioned in the box. The box only attempts to mention the “big picture” differences between J2EE and .NET. In terms of modifying the conclusions, students' responses will undoubtedly vary considerably depending upon the sources they have read and the programmers to whom they have talked. Those that disagree with the conclusions stated in the sidebar will probably argue that the .NET framework provides as much flexibility as J2EE and thus can handle complex Web

applications.

Among several possible references comparing J2EE and .NET, we especially suggest V. Ramesh and Arijit Sengupta, “J2EE vs. .NET: An Application Development Perspective,” in the *IS Management Handbook*, 8th edition, edited by Carol V. Brown and Heikki Topi, Auerbach Publications, Boca Raton, Florida, 2003, pages 415-423.

11. As you have read in newspapers and magazines, one firm seems to dominate the worldwide software market—Microsoft. With this degree of dominance by one firm, has the software industry truly been competitive, particularly over the past decade? Support your position.

As evidenced by relatively high software prices, competition has been less than optimal over the last decade. Development costs are high for competitive applications, and unit sales must be high to recoup these development costs. Thus, there are high barriers to entry in the industry. Small, successful firms with innovative products succumb to the fast profit from being bought out by the huge software firms. Because users want strong vendor support over the long term, they are generally unwilling to invest in products from smaller firms. Efficiency in marketing and distribution also favor larger firms. These factors favor the giants in the industry and tend to reduce competition.

Nevertheless, the entrepreneurial spirit is still alive and well in the software market, and new products pop up from new or established software vendors almost every day. While competition may have been less than optimal, innovation has not suffered.

12. In the late 1990s, the U.S. government, joined by several state governments, brought suit against Microsoft, arguing that Microsoft unfairly exercised monopoly power in the software industry. What was the outcome of these lawsuits? The European Union also brought suit against Microsoft for exercising monopoly power. What was the outcome of the European Union lawsuit? (Use the Web to conduct your research.)

For the federal antitrust case, the trial judge found for the government and against Microsoft, and ordered Microsoft to be split into two companies, an operating system company and an applications software company. On appeal, the court of appeals agreed that Microsoft had exercised monopoly power, but felt that the trial judge's order went too far. Instead, the court of appeals required Microsoft to change some of its marketing practices to be less predatory. For example, Microsoft could no longer require PC manufacturers to install Windows on all machines they sell, and Microsoft could no longer prohibit PC manufacturers from installing products from other software companies on new machines. In separate settlements, most of the states involved in the suit against Microsoft accepted a consent decree that was similar to the federal settlement.

In related cases, class-action suits against Microsoft for price fixing were filed in several states. Many of these class-action suits have been settled, with the result that buyers of Microsoft software packages were entitled to rebates.

In the European Union v. Microsoft antitrust case, the EU brought suit against Microsoft for abuse of its dominant position in the market. The suit started as a complaint over Microsoft's licensing practices (requiring suppliers of Microsoft's operating system to pay a royalty on each PC they sold, regardless of whether or not the PC contained Windows) and eventually grew to include a dispute over the lack of disclosure of some of the interfaces to the Windows operating system and the bundling of Microsoft's streaming media technology software with Windows. A settlement over Microsoft's licensing practices was reached in 1994, ending some of the questionable practices. A preliminary decision on the larger case was made in 2003 which ordered Microsoft to offer a separate version of Windows without

Windows Media Player and to offer the information necessary for competing network software to interact fully with both the desktop and server versions of Windows. In March 2004, the EU ordered Microsoft to pay a €497 million fine (the largest fine ever handed out by the EU at that time) in addition to divulging the server information (in 120 days) and producing a version of Windows without Windows Media Player (in 90 days). Microsoft produced a compliant version of Windows without Windows Media Player, and it did release some of the server source code by the deadline. Microsoft appealed the ruling, and a week-long hearing on the appeal ended in April 2006. In December 2005, the EU announced that it did not believe that Microsoft fully complied with the 2004 ruling (did not disclose all the appropriate information about its server programs), and it said that it would fine Microsoft €2 million a day until it did so. In June 2006 Microsoft stated that it had begun to provide the EU with the requested information, but the EU stated that it was too late. On July 12, 2006, the EU fined Microsoft an additional €280.5 million, €1.5 million a day from December 16, 2005, to June 20, 2006.

On September 17, 2007, Microsoft lost its appeal of the EU case. The €497 million fine was upheld, as were most of the other requirements of the original decision. In addition, Microsoft has to pay 80% of the legal costs of the European Commission, and the European Commission has to pay 20% of the legal costs of Microsoft. On October 22, 2007, Microsoft announced that it would comply with the decision, and it did not appeal within the required two months. However, some commentators believe that the final decision is not really a defeat for Microsoft (except for the monetary fine), because the interoperability information about its server programs will be available to anyone for a one-time €10,000 fee, and commercial vendors who use this information in their products will have to pay Microsoft 0.4% of the revenue from the products.

On February 27, 2008, the EU fined Microsoft an additional €899 million for failure to comply with the March 2004 antitrust decision. This represents the largest penalty ever imposed in 50 years of EU competition policy. On May 9, 2008, Microsoft lodged an appeal seeking to overturn the €899 million fine, stating that it intended to use the action as a “constructive effort to seek clarity from the court.” This appeal is still pending, as far as we know. Reference: “European Union v. Microsoft,” Wikipedia, n.wikipedia.org/wiki/European_Union_v._Microsoft.