Chapter 2
Information Technology and AISs

Discussion Questions

2-1. An AIS is best viewed as a set of interacting components that must all work together to accomplish data gathering, storage, processing, and output tasks. For example, computer hardware runs software, and each would be "lost" without the other. Similarly, software must have data to provide useful information. And all these components would be useless without people and procedures to maintain them, gather them, run them, and use them properly.

2-2. An understanding of information technology (IT) is important to accountants for many reasons. Some examples:

a) Much of today's accounting tasks are performed with computers. Thus, it is essential that the modern accountant possess a basic understanding of a computer's functions, capabilities, and limitations.
b) Accountants often help clients make hardware and software decisions. Knowledge of IT concepts is critical to these efforts.
c) Accounting information systems that are computerized must still be audited. It is impossible to audit such systems without a firm understanding of IT concepts.
d) Accountants are often asked to sit on evaluation committees when changes to existing accounting systems are contemplated. An understanding of how a computer operates enables the accountant to participate more intelligently in such committees.
e) Accountants are often asked to assist in the design of new computerized accounting information systems. Computer technology often plays an important role in this design work.
f) Most accounting systems require controls to assure the accuracy, timeliness, and completeness of the information generated by such systems. An understanding of how computer technology contributes to these objectives, and also how computer technology can thwart these objectives, enables the accountant to evaluate computer controls in an automated accounting environment.
g) Those accountants who understand how to use computer hardware and software will have the easiest time in performing such tasks as auditing, budgeting, database use, and so forth. Thus, the more accountants understand about information technology, the easier it is to get hired, noticed, and/or promoted.
h) A great deal of accounting data are gathered, transmitted, processed, and distributed via the Internet. A fundamental understanding of the information technology that drives these activities is therefore essential to the accountants that help perform these activities.

2-3. *Data transcription* refers to the transformation of data from source documents into machine-readable "computerized" input. Data transcription is unnecessary in manual accounting information systems because there is no computer. However, data transcription is critical to those computerized accounting information systems that collect data with manually-prepared source documents.

Data entry personnel typically transcribe data by copying them onto computer-readable media such as CDs, or more commonly, keying data directly into computers (e.g., when a bank clerk helps a customer make a deposit). Thus, data transcription is usually labor intensive and therefore costly. Data transcription also has the potential to insert errors into

data and/or to delay or “bottle-neck” operations. Designers of effective accounting information systems are willing to incur such costs because the benefits of the computerized processing from these systems make them cost-effective. However, data-preparation time and costs can be saved, and transcription delays avoided, if an AIS gathers data that are already in machine readable form (e.g., through automatic tag readers, bar codes, or magnetized-strip cards).

2-4. Computer input equipment includes computer keyboards, computer mouse, bar code readers, POS devices, MICR readers, OCR readers, magnetic strip readers, and such specialized microcomputer input devices as computer mice, joysticks, web cams, and microphones. A growing amount of accounting data is also now input via mobile devices such as smart phones and PDAs. The chapter describes the functioning of each of these devices in detail.

2-5. This question asks students to voice their personal opinions about red-light cameras—the ones that automatically issue traffic tickets when drivers run red lights. This question should therefore generate lively discussion. Many drivers hate them—for example, arguing that winter conditions made it difficult to stop or that such systems are more motivated by ticket revenues than by concerns for safety. Local government officials typically argue the opposite—i.e., that such systems merely enforce driving laws already on the books, serve a safety function, and save local residents money by generating revenues that could otherwise only be raised by other taxes.

2-6. The three components of the central processing unit are: (1) primary memory, (2) arithmetic/logic unit, and (3) control unit. As its name suggests, the *primary memory* of the CPU temporarily stores data and programs for execution purposes. The *arithmetic-logic units* of most central processors have special-purpose storage memories called registers that perform arithmetic operations (such as addition, subtraction, multiplication, division and exponentiation) and logical operations (such as comparisons and bit-manipulating functions). Finally, the *control sections* of central processing units act as an overseer of operations, interpreting program instructions and supervising their execution.

Microprocessor speeds are measured in *megahertz* (MHz) or gigahertz (GHz)—the number of pulses per second of the system’s timing clock. In larger computers, processor speed is also measured in millions of instructions per second (MIPS) or millions of floating point operations per second (MFLOPS). Processor speeds are rarely important to accounting systems because the speed of the processor drastically exceeds the speeds for input and output operations. Most computers are *I/O bound*, meaning that their CPUs mostly wait for data to be input or output.

2-7. The three types of printers mentioned in the text are dot-matrix printers, inkjet printers, and laser printers.

Dot-matrix printers

a) Advantages: (1) inexpensive, (2) flexible, and (3) able to print on multipart paper (i.e., make “carbon copies”)
b) Disadvantages: (1) slow print speeds, (2) low print resolutions

Ink-Jet Printers

a) Advantages: (1) higher print resolutions than most dot-matrix printers, (2) can print in multiple colors, (3) can print photographic prints, and continuous graphs, (4) selected models can perform faxing, copying, and scanning functions, and (5) comparatively inexpensive compared to laser printers

b) Disadvantages: (1) lower speeds (compared to laser printers), (2) can print single copies only (not carbon copies), and (3) ink cartridges are comparatively expensive

Laser Printers

a) Advantages: (1) high output quality, (2) fastest print speeds, (3) selected models can perform faxing, copying, and scanning functions
b) Disadvantages: (1) comparatively higher costs for both printers and toner cartridges, and (2) can print single copies only

2-8. Secondary storage devices provide a permanent, non-volatile medium for storing and retrieving accounting data. Examples include permanent hard disks, removable disks such as zip disks, CD-ROM disks, DVDs, flash (USB) drives, cartridge tape, and flash memory sticks (e.g., the type used in cameras). Secondary storage is important to AISs because the primary memory of a computer is too small and too volatile to meet the permanent-storage requirements of the typical accounting information system. In addition, such secondary storage media as CD-ROMs and USB devices are removable and therefore useful for backup, mailing, and distribution tasks. These media and their relative advantages and disadvantages are described at length in the chapter.

2-9. *Image processing* refers to storing graphic images in computer files (usually of business documents) and manipulating them electronically. Examples of image processing applications mentioned in the text include: insurance companies (storing claims forms and accident reports), banks (storing check images), hospitals (storing medical diagnostic scans), and the IRS (storing tax returns data). Other examples include catalog applications (storing merchandise images), personnel applications (storing employee pictures), and legal applications (storing mortgages, deeds, wills and other legal documents). Four advantages of image processing that are important to AISs are: (1) fast data capture, (2) archiving efficiency (the ability to store hundreds of thousands of documents on a small medium), (3) processing convenience (the ability to retrieve, catalog, sort, or otherwise organize images quickly and efficiently), and (4) accessibility (the ability to provide the same images to several users at once). This last, file-sharing advantage is also important for collaborative tasks in professional offices.

2-10. *Data communications protocols* are the standards by which computer devices communicate with one another. Examples of such standards include the packet size and format, the transmission rate, the duplex setting, the type of transmission (synchronous versus asynchronous), and the type of parity used (odd, even, or none). Communication protocols are important because they enable computers to transmit digital data over different types of communications media, and also to interpret data after the transmission takes place. For instance, if the parity bit for a character were different than the parity bit at the time it was transmitted, the character would either be different or unreadable.

2-11. *Local Area Networks (LANs)* are collections of computers, file servers, printers, and similar devices that are all located in a small area (e.g., the same building), and that are all connected to one another for communications purposes. The advantages of LANs are described in the chapter, and include: (1) ability to facilitate communication among LAN members, and between LAN members and the Internet, (2) sharing computer equipment, (3) sharing computer files, (4) saving software costs, and (5) enabling unlike computer equipment to communicate with one another.

2-12. *Client/server computing* is an alternate to mainframe/host computing. In centralized computing systems, the mainframe computer or minicomputer performs most, if not all, of the processing and database tasks, which are also mostly centralized. In

client/server computing, processing may be performed by the server computer or the client (typically, a microcomputer), and database information is usually copied onto several file servers.

Client/server systems offer several advantages. These include the ability to: (1) substitute the inexpensive processing capabilities of microcomputer hardware and software for comparatively expensive mainframe or minicomputer processing capabilities, (2) reduce data communications time and costs, and (3) utilize thin-client systems. Some disadvantages are: (1) the problem of maintaining multiple copies of the same databases on several servers, (2) the additional tasks required to keep server databases current, (3) more difficult backup and recovery, (4) increased difficulty when changing application software from one package to another, and (5) a potential need for greater user training. The security and auditability of client server systems are usually also more complex.

2-13. These days, almost any vendor that offers remote services could be classified as a cloud computing vendor. This includes those companies that perform basic payroll services such as Intuit, tax preparers that prepare tax returns remotely such as H. & R. Block, and even those universities that offer distance-education courses on the Internet. Cloud computing vendors offer the major advantages of other outsourcing suppliers along with near-instantaneous electronic speed (no more need for a courier service!). But cloud computing isn't always cheaper, faster, or better. Moreover, the quality of a vendor's work is not automatically guaranteed simply because it provides online services, and "security" is also a concern because the owner loses control of data. Finally, subscribers that become dependent upon their vendors run an added risk should data failures or data breaches occur.

2-14. Windowing operating systems such as Windows Vista and Windows 7 are operating systems that use *graphical user interfaces (GUIs)* with menus, icons, and other graphics elements. These elements enable users to select processing options and perform computing tasks without the need to memorize system commands. In contrast, command-driven operating systems such as DOS and UNIX force users to memorize system commands because available options are not usually listed or displayed onscreen.

Multitasking capabilities enable operating systems to perform more than one task on a single-user computer. Most windowing operating systems are multitasking systems that allow users to operate several concurrent sessions in separate windows, and to switch back and forth among them as needs dictate. Multitasking operating systems enable users to work more efficiently and perhaps be more productive. Windowing operating systems, GUIs, and multitasking operating systems are also important to AISs because so many other microcomputer accounting programs require them. For example, Peachtree, Solomon, Great Plains, Excel, Access, and Word software all run under Microsoft's Windows operating systems. These programs are used by accountants as personal and professional productivity tools, and also by auditors and the clients of CPA firms for similar reasons.

2-15. Four classes of application software are: (1) personal productivity software, (2) commercial productivity software, (3) accounting software, and (4) communications software. Other types of application software include database software, software for academics (e.g., grade-book management software), medical diagnostic software, game-playing software, software that processes marketing data, production data, personnel data, and enterprise resource planning (ERP) software.

Personal productivity software enables users to create and manipulate word documents (word processing software), create and manipulate spreadsheets (spreadsheet software),

create and manipulate databases (database management systems software), create and maintain calendars, or maintain personal budgets and finances (personal finance software). Commercial productivity software enables users to plan and track resources on large projects (project management software), design consumer or industrial products (CAD software), control manufacturing processes (CAM software), or create presentations (presentation graphics software).

Accounting software performs the familiar accounting tasks involved in payroll, accounts receivable, accounts payable, and inventory control. Chapter 7 of this text discusses integrated accounting packages in detail and Chapter 8 discusses the transaction cycles involved in these applications. Communications software enables users to email one another, transmit data to and from distant computers, and access the Internet and World Wide Web. Finally, ERP software enables businesses to transmit, manipulate, and integrate financial data on a corporate wide basis.

2-16. Computer programmers create the capabilities of each and every computer application by writing computer instructions in a *programming language* that a computer can understand and execute. *Fortran* (an acronym for "formula translation") was one of the first such languages, and excels in translating mathematical expressions into computer code. *COBOL* (Common Business Oriented Language) enables users to write programming instructions in English-like code and is comparatively self-documenting. *RPG* (Report Program Generator) is good for creating simple reports from existing databases and is widely supported by IBM on minicomputers. Some of the newer programming languages mentioned in the text include (1) *C++*, which excels at bit manipulations and assembler tasks, (2) *HTML* (HyperText Markup Language), which programmers use to create web pages, (3) *JAVA*, which programmers can use to create interactive websites, and (4) *Visual Basic*, which enables programmers to develop interactive windows programs with easily-manipulated, event-driven programming tools.

Problems

2-17. Classifying equipment:

Item:	***Classification:***
a) ALU	CPU component
b) CD-ROM	secondary storage device
c) keyboard	input equipment
d) modem	data communications
e) dot-matrix printer	output equipment
f) POS device	input equipment
g) MICR reader	input equipment
h) laser printer	output equipment
i) flash memory	secondary storage device
j) OCR reader	input equipment
k) magnetic hard disk	secondary storage device
l) ATM	input and output device
m) primary memory	CPU component

2-18. Defining acronyms:

Item:	***Meaning:***
a) POS	Point of sale
b) CPU	Central processing unit
c) OCR	Optical character recognition
d) MICR	Magnetic ink character recognition
e) ATM	Automated teller machine
f) RAM	Random access memory
g) ALU	Arithmetic-logic unit
h) MIPS	Millions of instructions per second
i) OS	Operating system
j) MHz	Megahertz
k) pixel	Picture element
l) CD-ROM	Compact disk - read only memory
m) worm	Write once read many
n) modem	Modulator demodulator
o) LAN	Local area network
p) WAN	Wide area network
q) RFID	radio frequency identification
r) WAP	Wireless application protocol
s) Wi-Fi	Wireless fidelity
t) ppm	Pages per minute
u) dpi	Dots per inch
v) NFC	Near field communications

2-19.

a) one DVD disk capacity = 17 gigabytes
b) one hard disk capacity = 160 gigabytes
c) ten CD-ROM disks = 10 * 650 megabytes = 6,500 megabytes = 6.5 gigabytes

Conclusion: Choice (b) holds the most data.

2-20.

500*(1024^3) = 536,870,912,000 bytes

2-21. Brian Fry Products

	character positions	***field***
a)	1-4	order number
b)	5-9	part number
c)	10-19	part description
d)	20-22	manufacturing department
e)	23-27	number of pieces started
f)	28-32	number of pieces finished
g)	33-34	machine number
h)	35-42	date work started (MM/DD/YYYY)
i)	43-46	hour work started
j)	47-54	date work completed (MM/DD/YYYY)
k)	55-58	hour work completed
l)	59-61	work standard per hour
m)	62-66	worker number
n)	67-71	foreman number

2-22. Go the AICPA website and identify the top ten information technologies for the current year.
http://www.aicpa.org/InterestAreas/InformationTechnology/Resources/TopTechnologyInitiatives/Pages/2010TopTenInitiatives-Complete.aspx

At the time this answer key was prepared, they were:

1) electronic data interchange (EDI - hardware)
2) database accounting software
3) local area networks (hardware and software)
4) client/server computing (hardware)
5) open systems (hardware and software)
6) downsizing (hardware, but also people)
7) continuous auditing (software)
8) image processing (hardware and software)
9) decision support systems (software)
10) expert systems (software)

Some current important trends and topics not mentioned are such items as computer viruses, the Internet and the World Wide Web, electronic commerce, Internet taxation, software piracy, privacy on the Internet, and the Telecommunications Act of 1996.

2-23. An RFID system for a state's toll roads.

	Debit		*Credit*	
	Account Title	*Amount*	*Account Title*	*Amount*
a.	Cash	20.00	Transponder Sales	20.00
b.	Cash	100.00	Transponder Deposits	100.00
c.	Transponder Deposits	900.00	Credit Cards Receivable	900.00
d.	Transponder Deposits	25.75	Cash	25.75
e.	Owner's Equity	10.00	Cash	10.00

2-24. This problem requires students to select a type of computer hardware of interest and to write a one-page report. We recommend requiring students to use a spreadsheet with which to embed pictures of three different hardware examples in separate cells. We found that the results are interesting and fun to grade, and that some of our students were surprised to learn that they can embed pictures in spreadsheets.

Case Analyses

2-25. Pucinelli Supermarkets

Example:	Computations (Column B)
UPC Code:	064200115896
Length Test:	OK
Check Digit is:	6
Sum of odd digits:	19
Sum of even digits:	17
Add digits x 3:	57
Sum:	74
Last digit:	4
Computed check digit:	6
Conclusion:	valid number

Formulas for Column B

064200115896 (Stored in cell B2)

=IF(LEN(B2)=12, "OK", "Not OK")

=RIGHT(B2,1)

=MID(B2, 1, 1) + MID(B2, 3, 1) + MID(B2, 5, 1) + MID(B2, 7, 1) + MID(B2, 9, 1) + MID(B2, 11, 1)

=MID(B2, 2, 1) + MID(B2, 4, 1)+MID(B2, 6, 1) + MID(B2, 8, 1)+ MID(B2, 10,1)

=3*B5

=SUM(B6:B7)

=RIGHT(B8,1)

=IF(B9=0, 0, 10-B9)

=IF(AND(B3="OK",VALUE(B10)=VALUE(B4)),"valid number", "invalid number")

1.

UPC Code:	639277240453
Length Test:	OK
Check Digit is:	3
Sum of odd digits:	29
Sum of even digits:	20
Add digits x 3:	87
Sum:	107
Last digit:	7
Computed check digit:	3
Conclusion:	valid number

2.

UPC Code:	040000234548
Length Test:	OK
Check Digit is:	8
Sum of odd digits:	10
Sum of even digits:	12
Add digits x 3:	30
Sum:	42
Last digit:	2
Computed check digit:	8
Conclusion:	valid number

3.

UPC Code:	034000087884
Length Test:	OK
Check Digit is:	4
Sum of odd digits:	19
Sum of even digits:	19
Add digits x 3:	57
Sum:	76
Last digit:	6
Computed check digit:	4
Conclusion:	valid number

4.

UPC Code:	048109352495
Length Test:	OK
Check Digit is:	5
Sum of odd digits:	22
Sum of even digits:	23
Add digits x 3:	66
Sum:	89
Last digit:	9
Computed check digit:	1
Conclusion:	invalid number

2-26. Savage Motors (Software Training)

Department	No. of Employees	Word Processing	Spread-sheets	Database	Presentation Graphics	Accounting
Sales	112	1150	750	900	500	700
Operations	82	320	2450	650	100	500
Accounting	55	750	3600	820	250	2500

Answers for Part 1:	No. of Employees	Word Processing	Spread-sheets	Database	Presentation Graphcs	Accounting
Sales	112	10.3	6.7	8	4.5	6.3
Operations	82	3.9	29.9	7.9	1.2	6.1
Accounting	55	13.6	65.5	14.9	4.6	45.5

Answers for Part 2:

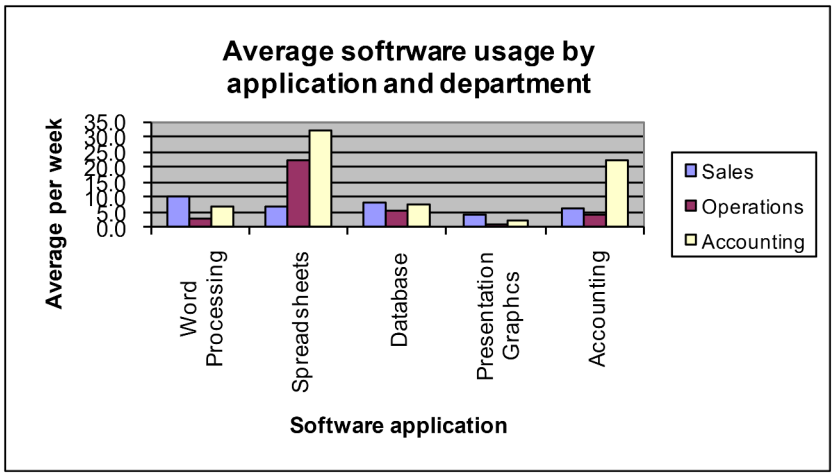
Sales	1150	Word Processing
Operations	2450	Spreadsheets
Accounting	3600	Spreadsheets

Answers for Part 3:

Totals:	249	2,220	6,800	2,370	850	3,700
Averages:		8.9	27.3	9.5	3.4	14.9

Spreadsheets are used the most hours.

Answer to Part 4:



Answer to Part 5:
Answers will vary by students.

2-27. Backwater University

1. One possible solution is to use a coupon system for students. With this system, students would be given meal coupons rather than ID cards, and the coupon itself "pays" for the meal. Another possibility is to install a local area network in the dining facilities,

and use point-of-sale (POS) terminals to check students through the lines. For this latter option, it would probably make sense to use student ID cards with magnetic stripes for faster throughput. A third solution, similar to the second, is to use fingerprint recognition software and a database of authorized students to check them through the lunch lines. Students will probably develop several additional alternatives for this question.

2. No additional hardware is required for the coupon plan, although a centralized database of students on a microcomputer system would be useful for printing coupons each month. In contrast, the two LAN systems will require a file server, POS or biometric scanning terminals, and at least one administrative computer for inputting ID information for those students approved for a specific type of meal plan.

3. The software required for the coupon system would maintain a central database of student data, including identifying information about the student and the type of meal plan desired. A coupon-printing system could print coupons with student names on each one once a month. The software for the POS or biometric systems would also maintain a centralized list of students, plus information indicating whether or not a student used his or her card for a specific meal (thus controlling the multi-meal problem mentioned in the case).

4. Good information systems pay for themselves quickly. Thus, when evaluating the desirability of either system, the analysis should show that the proposed system is cost effective. The costs of the proposed system include the hardware, software, and personnel mentioned above. The benefits of a proposed system include reduced customer lines at the entrance to the dining facilities, better control of student funds and plans, and perhaps even reduced cashiering labor. More discussions about such system analyses are found in later chapters of the book.

2-28. Bennet National Bank

1. The special information that must be coded on the magnetic strip of the card would include, but would not necessarily be limited to:
   a) special bank code
   b) customer's credit card number
   c) customer's savings account number
   d) customer's checking account number
   e) expiration date of card
   f) issue date of the card
   g) date of last use for automatic withdrawal purposes
   h) the number of withdrawals on date of last withdrawal
   i) secret passcode

2. The tests of conformity with bank policy and locations for such tests would be:

a)	correct passcode test	performed by client
b)	Bennet credit card test	performed by client
c)	current credit card test	performed by client
d)	stolen credit card test	performed by bank's CPU using central files
e)	amount of usage test	performed by client
f)	overdrawing of account test	performed by bank's CPU using central files

2-29. Morrigan Department Stores

Genera comment: This case discusses the difficulties that most companies, government agencies, and individuals face when new hardware or new versions of familiar software force individuals to learn, or relearn, how to accomplish old tasks on new computer systems. Inasmuch as this phenomena is usually well-understood by students, the case can lead to lively discussions of the pains and gains involved in these upgrades.

1. Roberta Gardner's description of "64-bit machines" is not wrong, but probably overly simplifies what this term means. The transition to 64-bit microprocessor designs represents a doubling of register size from earlier 32-bit designs, and is a natural extension of the processing capabilities of mainframe computers to microcomputers. The newer, 64-bit systems enable personal computers to access more random access memory as well as perform large-number computations with more significant digits. However, along with these improvements in hardware processing capabilities has come newer software that can take advantage of these capabilities. In the case of Microsoft's 2010 Office suite, for example, the changes were considerable, requiring users to relearn how to perform formerly familiar tasks using unfamiliar menus and commands.

2. Possible arguments *against* upgrading current hardware or software include:
   A. avoid the costs of such hardware and/or software
   B. the convenience of using current software, which is usually well understood
   C. compatibility with current accounting applications
   D. savings in training time and cost
   E. ability to manage without them

3. Possible arguments in favor of upgrading current hardware or software include:
   A. compatibility with the word processing, spreadsheet, or database files in other departments or branch offices
   B. free software support from vendors
   C. the potential to acquire more capable software than the older versions
   D. the ability to run new software on new, 64-bit devices
   E. increased speed of processing
   F. better security

4. Students are likely to have conflicting views on whether hardware or software upgrades are "more hype than real." For example, newer operating systems are likely to include additional security features such as better anti-virus protection—a very real advantage—as is the ability to address more bytes of random access memory. It is less clear whether or not the newer versions of say, word processors, are worth the incremental costs in time and effort required to learn how to use them—a question that can best be answered on a case by case basis.

5. This question asks students if they feel if it is ethical for software vendors such as Microsoft, Adobe or Apple to ship software packages with both known and unknown defects in them. While most students are willing to make allowances for "unknown defects," few are likely to feel that it is ethical for these vendors to ship software with known defects. Hopefully, at least some students will distinguish between "ethical" and "practical," noting that there will always be some "bugs" in large, integrated and complicated software packages.

6. This question asks students if they agree with the argument that "many hardware and/or software upgrades are unnecessary." Most students are likely to agree that <u>some</u>

upgrades are unnecessary. Thus, a good question to also ask is "are there some upgrades that are necessary?" In answering this question, some students will note that upgrading virus protection software, operating systems, and (eventually) application software is inevitable.

7. Students are likely to agree with Alex McLeod's statement that companies should provide training. However, the expectation to learn software "on your own" is a common policy and common expectation especially characteristic of corporate policy in times of tight budgets. Instructors might point out here that end users sometimes skip software training even when it is offered—a factor that sometimes leads to huge implementation failures. An example may be found in the case by Baltzan and Phillips (2009). "Campus ERP" (Boston: McGraw-Hill/Irwin), pp. 356-357. It might also be worth noting here that the expectation to "keep current" includes a working knowledge of current software as well as a hallmark of professional accountants.

8. This question asks students whether or not they feel it was necessary for the corporate participants in this case to physically meet in one location. Certainly, with the (often free) availability of conferencing software such as Skype or other messaging software, for example, virtual meetings are easily arranged and of course, save companies travel funds. On the other hand, employees are likely to both attend and appreciate the rest and relaxation afforded meetings in lovely tropical settings, and is a benefit likely to foster both employee loyalty and motivation. Students may also mention that traveling to a distant location often leads to increased understanding of problems of other people.