Experiencing MIS

9th edition

David M. Kroenke
Randall J. Boyle

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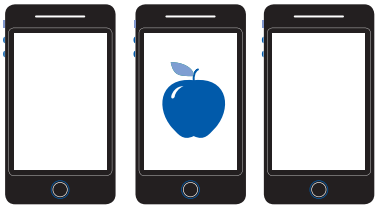

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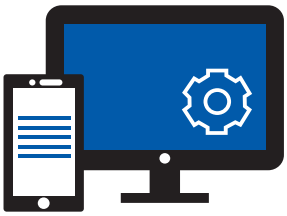

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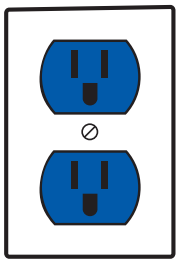

Dear Student,

Honestly, this is a fun class. It's fun to take because you'll learn about things that dominate news headlines every day. You'll learn about things like self-driving cars, 3D printing, social media, Big Data, virtual reality, the cloud, and cybersecurity. No, it's not a programming class. It's not intended to be a class where you learn a bunch of boring technical terms and computer code. Not at all.

This class is about using technology to create value. For example, the smartphone sitting next to you is a piece of technology that is probably very valuable to you. It's an amazing piece of hardware that contains software, databases, and artificial intelligence agents. You use it to browse the Web, collaborate with friends, take pictures, post to social media, and make online purchases. More than 99 percent of college students have a smartphone, and 50 percent say they can't live without it. That's value, and they're willing to pay for it.

And that's What information systems are all about. Innovators like Steve Jobs, Bill Gates, Larry Ellison, Mark Zuckerberg, Larry Page, Sergey Brin, and Jeff Bezos have used technology to create value for their customers. As a result, they have made billions of dollars, revolutionized commerce, and created some of the largest companies in the world. And you can do the same thing in your personal life.

You can use technology to get a great job, increase your earning potential, and become indispensable to your future employer. You may not be a superstar entrepreneur like Steve Jobs, but you can exceed beyond your expectations by applying the knowledge you learn in this class. Companies are becoming increasingly dependent on technology. They need people who understand how to use *new* technology to solve *new* types of problems. And that's you.

Think about it. Over time, technology creates new jobs that didn't exist before. Mobile application developers, social media analysts, information security specialists, business intelligence analysts, and data architects didn't exist 20—even 10—years ago. Similarly, the best jobs 20 years from now probably don't currently exist.

The trick to turning information systems to your advantage is being able to predict technological innovations and then get ahead of them. During your career, you will find many opportunities for the innovative application of information systems in business and government—but only if you know how to look for them.

Once found, those opportunities become your opportunities when you—as a skilled, creative, non-routine problem solver—apply emerging technology to facilitate your organization's strategy. This is true whether your job is in marketing, operations, sales, accounting, finance, entrepreneurship, or another discipline.

Congratulations on deciding to study business. Use this course to help you obtain and then thrive in an interesting and rewarding career. Learn more than just the MIS terminology—understand the ways information systems are transforming business and the many, many ways you can participate in that transformation.

In this endeavor, we wish you, a future business professional, the very best success!

Randy Boyle & David Kroenke

The Guides

Each chapter includes two unique guides that focus on current issues in information systems. In each chapter, one of the guides focuses on an ethical issue in business. The other guide focuses on careers in the field of information systems. The content of each guide is designed to stimulate thought, discussion, and active participation in order to help *you* develop your problem-solving skills and become a better business professional.

Chapter 1
Ethics Guide: Ethics and Professional Responsibility, p. 20
Career Guide: Five-Component Careers, p. 22

Chapter 2
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Career Guide: Senior Learning and Development Specialist, p. 47

Chapter 3
Ethics Guide: MIS-diagnosis, p. 74
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Chapter 4
Ethics Guide: Free Apps for Data, p. 107
Career Guide: Senior Software Engineer, p. 109

Chapter 5
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Career Guide: Principal Data Engineer, p. 137

Chapter 6
Ethics Guide: Reverse Engineering Privacy, p. 168
Career Guide: Senior Network Manager, p. 169

Chapter 7
Ethics Guide: Big Brother Wearables, p. 191
Career Guide: Senior Product Manager, p. 192

Chapter 8
Ethics Guide: Paid Deletion, p. 217
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Chapter 9
Ethics Guide: Synthetic Friends, p. 251
Career Guide: Social Media/Online Reputation Manager, p. 252

Chapter 10
Ethics Guide: Web Recording Everything, p. 287
Career Guide: Manager, Cybersecurity and Privacy, p. 289

Chapter 11
Ethics Guide: Training Your Replacement, p. 312
Career Guide: Data Governance Officer, p. 313

Chapter 12
Ethics Guide: Engineered Slowdown, p. 338
Career Guide: Developing Your Personal Brand, p. 339

Chapter Extension 15
Career Guide: Director, Asian Operations, p. 570

Learning Aids for Students

We have structured this book so you can maximize the benefit from the time you spend reading it. As shown in the following table, each chapter includes a series of learning aids to help you succeed in this course.

Resource	Description	Benefit	Example
Question-Driven Chapter Learning Objectives	These queries, and the subsequent chapter sections written around them, focus your attention and make your reading more efficient.	Identify the main point of the section. When you can answer each question, you've learned the main point of the section.	Chapter 6, 6-1: Why Is the Cloud the Future for Most Organizations?
Guides	Each chapter includes two guides that focus on current issues relating to information systems. One addresses ethics, and the other addresses information systems careers.	Stimulate thought and discussion. Learn about real-world IS jobs. Help you learn to respond to ethical dilemmas in business.	Chapter 5 *Ethics Guide:* Mining at Work Chapter 9 *Career Guide:* Social Media/Online Reputation Manager
So What?	Each chapter of this text includes a feature called So What? This feature presents a current issue in IS that is relevant to the chapter content and asks you to consider why that issue matters to you as a future business professional.	Understand how the material in the chapter applies to everyday situations.	Chapter 2 So What?: Amazon Eats Whole Foods
How Does the Knowledge in This Chapter Help You? (near the end of each chapter)	This section revisits the opening scenario and discusses what the chapter taught you about it.	Summarizes the "takeaway" points from the chapter as they apply to the company or person in the story and to you.	Chapter 11 How Does the Knowledge in This Chapter Help You?
Active Review	Each chapter concludes with a summary-and-review section organized around the chapter's learning objectives.	Offers a review of important points in the chapter. If you can answer the questions posed, you understand the material.	Chapter 9 Active Review
Key Terms and Concepts	Highlight the major terms and concepts with their appropriate page references.	Provide a summary of key terms for review before exams.	Chapter 6 Key Terms and Concepts
End of Chapter Questions	These exercises ask you to take your new knowledge one step further by applying it to a practice problem.	Tests your critical thinking skills and keeps reminding you that you are learning material that applies to the real world.	Chapter 4 End of Chapter Questions
Collaboration Exercise	A team exercise that focuses on the chapter's topic.	Use Google Drive, Windows OneDrive, Microsoft SharePoint, or some other tool to collaborate on team answers.	Collaboration Exercise 2, which discusses how to tailor a high-end resort's information system to fit its competitive strategy
Case Study	A case study closes each chapter. You will reflect on real organizations' use of the technology or systems presented in the chapter and recommend solutions to business problems.	Requires you to apply newly acquired knowledge to real situations.	Case Study 6: Salesforce.com
Application Exercises (at the end of the book)	These exercises ask you to solve business situations using spreadsheet (Excel), database (Access), or Web applications.	Help develop your computer skills.	AE6-2, which builds on your knowledge from Chapter 6 by asking you to import spreadsheet data into Access and produce cost reports
SharePoint Hosting	Pearson will host Microsoft SharePoint site collections for your university. Students need access to MyLab MIS and a browser to participate.	Enables students to collaborate using the world's most popular collaboration software.	

Experiencing MIS

Ninth Edition

David M. Kroenke

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To C. J., Carter, and Charlotte
—David Kroenke

To Courtney, Noah, Fiona, Layla, and Henry
—Randy Boyle

Contents Overview

Experiencing MIS offers basic topic coverage of MIS in its 12 chapters and more in-depth, expanded coverage in its chapter extensions. This modular organization allows you to pick and choose among those topics. Here chapter extensions are shown below the chapters to which they are related. You will preserve continuity if you use each of the 12 chapters in sequence. In most cases, a chapter extension can be covered any time in the course after its related chapter. You need not use any of the chapter extensions if time is short.

Brief Contents

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Preface

In Chapter 1, we claim that MIS is the most important class in the business curriculum. That's a bold statement, and every year we ask whether it remains true. Is there any discipline having a greater impact on contemporary business and government than IS? We continue to doubt there is. Every year brings important new technology to organizations, and many of these organizations respond by creating innovative applications that increase productivity and help them accomplish their strategies.

Over the past year, we've seen long-discussed innovations take big leaps forward. Self-driving vehicles made huge strides over the past year. Uber, Tesla Motors, and Waymo (Google) logged millions of autonomous miles. Nearly all other automobile manufacturers are running full-tilt to turn their traditional cars into fully autonomous smart cars. A recent study by Intel estimates self-driving vehicle services will be worth $7 trillion by 2050.[1] Consider what will happen when Amazon starts formal adoption of the self-driving trucks they're currently testing. It could reduce shipping costs by 80 percent!

At the annual Consumer Electronics Show (CES) in 2018, Toyota announced an autonomous concept vehicle named the e-Palette that the company believes will fulfill a role in an emerging mobility as a service (MaaS) market. By mid-2019, Subaru, Suzuki Motor Corp., Mazda Motor Corp., Isuzu Motors, and Toyota had all invested in a joint venture to utilize the e-Palette platform.

This year, roll-up TVs were a hit at CES. Harley-Davidson showed off its new all-electric motorcycle named LiveWire; it can go 0 to 60 in 3.5 seconds, travel 200 miles on a single charge, and use a power regeneration mode to slow the motorcycle. There were also a gaggle of smart devices like Jabra's smart headphones. The adaptive headphones are powered by an AI that adapts to the environment they're in. They analyze the sounds in the environment and adjust their noise-canceling abilities automatically. Businesses see the potential value in smart devices such as these. They also recognize the need to collect, store, and analyze the data these devices generate. As a result, jobs in analytics, business intelligence, and Big Data are all in high demand right now.

Digital reality (sometimes called virtual reality) has really taken off. Microsoft showed off its second-generation device named Hololens 2, which will be released in late 2019. Google also showed off a demo of its device named Magic Leap, but received a lukewarm reception. Expectations are high for Magic Leap considering that investors have put a record-breaking $4.5 billion into this secretive startup.

The reviews for digital reality devices from early adopters are glowing. These devices will create entirely new types of companies and could change the way people live, work, shop, and entertain themselves.

In addition to changing the ways individuals live and gather data, recent innovations are changing the way companies work, too. For example, over the past year Amazon experienced tremendous success using Kiva robots in its fulfillment centers. It expanded use of these robots to dozens of warehouses around the world. These 200,000 Kiva robots have reduced operating costs by 20 percent ($22 million per warehouse); they have also reduced click-to-ship times by 75 percent.[2] If Amazon rolls out these robots to all of its 110 warehouses, it could save billions. Technology—in this case, an automated workforce—is fundamentally changing the way organizations operate. It's enabling them to be more productive, innovative, and adaptable.

Of course, not all of this year's technology news has been good. Large-scale data breaches continue to be a major problem. In 2018, some of the largest data breaches included Marriot International (500M accounts), Under Armour (150M accounts), and Twitter (330M accounts). And 2019 looks to be even worse. We've already seen losses by First American Corp (885M accounts), Facebook (540M accounts), Exactis (340M accounts), and Quora (100M accounts).[3] Overall, businesses accounted for 66 percent of stolen accounts. And these are just a fraction of the total number of organizations affected this year.

This edition of the text has been updated for these developments as well as normal revisions that address emergent technologies like artificial intelligence, machine learning, cloud-based services, and so on.

All of these changes highlight the fact that more sophisticated and demanding users push organizations into a rapidly changing future—one that requires continual adjustments in business planning. In order to participate in this business environment, our graduates need to know how to apply emerging technologies to better achieve their organizations' strategies. Knowledge of MIS is critical to this endeavor. And this pace continues to remind us of Carrie Fisher's statement, "The problem with instantaneous gratification is that it's just not fast enough."

Why This Ninth Edition?

To reiterate the preface of earlier editions, we believe it is exceedingly important to make frequent adaptations to this text because of the delays associated with long textbook

Table 1 Changes in the Ninth Edition

Chapter	Description of Change
1	New eHermes introduction
	New and updated charts for CPU and data storage growth
	New job sector comparison statistics
	Discussion of the MIS skills gap
	Updated BLS job statistics for business and MIS occupations
	New collaboration exercise (creating a collaboration system)
	New section on Information (1-5)
	New section on data characteristics (1-6)
	New case study (Pluralsight)
2	New eHermes introduction
	Chapter content moved up from Chapter 3
	New So What? Guide (Amazon Eats Whole Foods)
	Added discussion of first and second mover advantages
	Added discussion of business processes, BPM, repositories, and activities
	Updated Amazon case study
	New Career Guide (Senior Learning and Development Specialist)
	New Collaboration Exercise (Singing Valley Resort)
	New discussion about business process modeling (2-5)
3	New eHermes introduction
	Chapter content moved up from Chapter 9
	New So What? Guide (Geofencing for Businesses)
	Updated Access 2019 images
4	New eHermes introduction
	New So What? Guide (New from CES 2019)
	New Career Guide (Senior Software Engineer)
	Added discussion about cryptocurrencies, Bitcoin, blockchain, and phablets (4-2)
	Updated industry statistics throughout the chapter
5	New eHermes introduction
	New Ethics Guide (Mining at Work)
	New Career Guide (Principal Data Engineer)
	New section 5-7 discussing databases at eHermes
	Updated images and statistics throughout the chapter
	Updated Excel and Access 2019 images
6	New eHermes introduction
	New So What? Guide (IRS Systems Overtaxed)
	New Ethics Guide (Reverse Engineering Privacy)
	Updated industry statistics throughout the chapter
	Updated section 6-3 discussing eHermes using the cloud
	New Case Study (Salesforce.com)
	Updated discussion about telemedicine
	New MyLab MIS question about AWS offerings and eHermes
7	New Chapter on Collaboration Information Systems
	7-1 What Are the Two Key Characteristics of Collaboration?
	7-2 What Are Three Criteria for Successful Collaboration?
	7-3 What Are the Four Primary Purposes of Collaboration?
	7-4 What Are the Components and Functions of a Collaboration Information System?
	New So What? Guide (Future of the Gig Economy)
	New Career Guide (Senior Product Manager)
	New Ethics Guide (Big Brother Wearables)

Table 1 Changes in the Ninth Edition (*continued*)

Chapter	Description of Change
	New Case Study (Airbnb)
	New collaboration exercise
8	New ARES Systems introduction
	New discussion on structured versus dynamic processes (8-1)
	New discussion of workgroup, enterprise, and inter-enterprise processes (8-1)
	New discussion of process efficiency versus process effectiveness (8-2)
	New discussion of enterprise application solutions (8-4)
	New So What? Guide (Digital Dining)
	New Career Guide (Platform Engineer)
9	New Career Guide (Social Media Marketing)
	New Case Study (LinkedIn)
	New discussion about Geofencing
	Updated collaboration exercise
	Updated industry statistics and charts throughout the chapter
	Updated discussion about the future of social media (9-6)
10	New So What? Guide (Largest! Data! Breach! Ever!)
	New Ethics Guide (Web Recording Everything)
	New industry statistics and charts throughout the chapter
	New discussion about legal safeguards for data including PCI DSS, GLBA, and HIPAA
11	New So What? Guide (Poor Data Management at Facebook)
	New Career Guide (Data Governance Officer)
	Updated industry statistics and charts throughout the chapter
12	New Ethics Guide (Engineered Slowdown)
	New charts and statistics about agile and scrum use
Chapter Extensions	**Description of Change**
Appl Ex	Updated data files
	Updated Microsoft Office 2019 compliant files and chapter images
	New exercise about Microsoft AI applications Fetch! and How-Old
	New exercise about networking commands ping and ipconfig
	New exercise about Recuva file recovery
	New exercise about Microsoft MakeCode application development
CE1	Chapter content and images updated to Microsoft Excel 2019
CE2	Updated chapter statistics and charts
CE5	Updated mobile statistics
	Removed references to depreciated Microsoft charms
CE6	Chapter content and images updated to Microsoft Access 365
CE7	Chapter content and images updated to Microsoft Access 365
CE8	Chapter content and images updated to Microsoft Access 365 and Microsoft Excel 2019
	Updated chapter project instructions
CE9	Updated discussion about ICANN and net neutrality
	Updated chapter statistics
CE10	New Microsoft Whiteboard example
	Updated Google Drive images
	Updated SharePoint images
CE11	Updated chapter statistics about ERP leaders and ERP adoption
CE13	Updated chapter statistics and ESN example using Cummins
CE14	Updated data breach statistics and charts
	New section on user role in IS security (CE14-6)
	New chart showing the most commonly used weak passwords

Chapter	Description of Change
CE15	Updated statistics about international Internet access (fixed and mobile)
	New discussion of the General Data Protection Regulation (GDPR) law
	Updated statistics related to spoken languages
	Updated examples of bribery and asset seizure
CE18	Updated images for Microsoft Project Professional 2019
	Updated statistics and charts related to agile and scrum usage

revision cycles. Text materials we develop in April of one year are published in January of the next year and are first used by students in September—a minimum 17-month delay.

For some areas of study, a year and a half may not seem long because little changes in that amount of time. But in MIS, entire companies can be founded and then sold for billions of dollars in just a few years. YouTube, for example, was founded in February 2005 and then sold in November 2006 to Google for $1.65B (21 months). And that wasn't just a one-time fluke. Facebook Inc. started in 2004, led the social media revolution, and became a public company currently (as of mid-2019) valued at $551B. That's a whopping $36B in growth per year for 15 years! MIS changes fast—very fast. We hope this new edition is the most up-to-date MIS textbook available.

The changes in this ninth edition are listed in Table 1. The chapter on Business Intelligence Systems was pulled forward to Chapter 3 because of the increased importance of these systems to all businesses. Every large tech company has spent considerable resources acquiring artificial intelligence (AI) companies in the past ten years, including Google ($3.9 billion), Amazon ($871 million), Apple ($786), Intel ($776), and Microsoft ($690).[4] And that's not counting additional internal investments. AI and machine learning are becoming core parts of these companies' competitive advantage. Some of the highest-paying jobs are in AI, business analytics, Big Data, and data mining.

Even consumers are being affected. Consumers are interacting with AIs like Alexa, Google, and Siri in their homes on a daily basis. Machine learning is being used to make personalized recommendations for online shoppers. It's also being used to create automated Gmail replies, optimize Uber arrival times, and identify which songs you'll want to listen to.

A new chapter on Collaboration Information Systems (Chapter 7) was added to Part 3 (MIS in Organizations) because it focuses on systems in organizations, much like Chapters 8 and 9 do. MIS professors who reviewed the book said they assign a lot of group work and that they wanted content to help their students work more effectively within their groups. Chapter Extension 10 covers collaboration software options that students can use to manage their assigned projects.

To make room for the new chapter, the content from the previous edition's Chapter 2 was split and integrated into this edition's Chapter 1 and Chapter 2. Content in Chapter 8 was also expanded to include more discussion about processes in systems. We hope this new organization of chapters will make the presentation of the chapters flow more naturally.

Chapters 1 through 6 begin with a new discussion of eHermes, a startup that provides mobile shopping experiences using self-driving vehicles. Chapters 7 through 12 continue to be introduced by the discussion of ARES Systems, a cloud-based augmented-reality exercise startup. In addition to motivating the chapter material, both case scenarios provide numerous opportunities for students to practice one of Chapter 1's key skills: "Assess, evaluate, and apply emerging technology to business."

This edition also continues to focus on teaching ethics. Every Ethics Guide asks students to apply Immanuel Kant's categorical imperative, Bentham and Mill's utilitarianism, or both to the business situation described in the guide. We hope you find the ethical considerations rich and deep with these exercises. The categorical imperative is introduced in the Ethics Guide in Chapter 1 (pages 20–21), and utilitarianism is introduced in the Ethics Guide in Chapter 2 (pages 46–47).

As shown in Table 1, additional changes were made to every chapter, including eight new So What? features, five new Ethics Guides, seven new Career Guides, and four new chapter cases. Numerous changes were made throughout the chapters in an attempt to keep them up-to-date. MIS moves fast, and to keep the text current, we checked every fact, data point, sentence, and industry reference for obsolescence and replaced them as necessary.

Structure, Organization, and Appearance of This Text

Teaching today is a very different endeavor than it was years ago. Students have many more distractions and demands on their time. They are quick to tune in and quick to tune out, so much so that someone compared their attention spans to those of Labrador Retriever puppies. We can lament that fact, but we can't change it. What we can do is to meet students where they are and creatively attempt to obtain their engagement.

We designed this text with that hope and goal in mind. Every feature of this book is designed to make it easy for

students to engage with the content, not by watering it down but rather, we hope, by making it interesting and relevant to them. This text is not an encyclopedia; it attempts to teach essential topics well. It does so by providing opportunities for students to actively engage with the content, by providing features to help students better manage their study time, and by having an appearance that makes it easy for students to pick up and start.

Active Engagement

The structure of this edition of *Experiencing MIS* provides many opportunities for active engagement. Each chapter includes a So What? feature that contains exercises and questions for students to answer to demonstrate the relevancy of the chapter's material to them. Each chapter also contains an Ethics Guide that looks at the ethical implications of the chapter content. These can be used for small in-class exercises. Finally, this edition contains 39 application exercises.

Facilitate Student Study

Today's students were reared in an environment of constant stimulation and channel surfing, and it seems nearly impossible for many students to focus on a single topic for more than a few minutes. Again, we can wish it otherwise, but short attention spans are students' and our reality. And recent research does seem to substantiate students' claim that, except for texting in class, students can multitask in class without problem.[5]

This text is structured to accommodate today's students' learning styles. First, to help students manage their time, it is organized around questions. The learning objectives for each chapter or chapter extension are presented as a list of questions. Each major heading of the material is one of those questions, and the end of the chapter or extension includes an Active Review in which students are asked to demonstrate their learning of the answer to each question. Students should study until they can answer the questions; that may be 5 minutes or 5 hours, but their job is to answer those questions. This technique, from Marilla Svinicki's research, vastly helps students manage their study time.[6]

You can also use the questions to structure class sessions or at least parts of those sessions. You can open class by asking students to "do the questions." Go around the room and call on someone to answer a question or part of one.

Second, students learn more when they are emotionally engaged in the material. The purpose of the vignettes that introduce each chapter is to raise student emotion; their purpose is to cause students to care about the chapter material.

Third, 82 percent of students in the business school prefer visual learning to auditory (voice or word) learning.[7] To make it easier for students to open this book and continue to read it, interesting and engaging art and photos have been used. *In every instance, however, we have insisted that the photo or art be related to the topic under discussion; these photos are not simply eye candy.* Pearson allows us to personally review and approve every photo and art exhibit in this text. We believe a good book does not have to appear boring, but all art must be relevant.

Features for Engaging the Student

Experiencing MIS was written to make it impossible for readers of this text to miss the importance of MIS in business. The text is designed to be approachable, easy to use, sometimes humorous, with an upbeat and in-your-face attitude, but always with the goal of underlining the importance of MIS to all businesspeople in the 21st century.

An important part of making the text approachable was choosing a modular design. The text consists of 12 short chapters along with 18 supplemental discussions, called chapter extensions.

The modular nature of this text is discussed in more detail later in this preface.

Emphasis on Collaboration

As with previous editions, this text emphasizes collaboration. It is one of Reich's key skills for the 21st-century professional, as described in Chapter 1. We believe we need not only to require our students to collaborate but also to teach them key skills for doing so. Chapter 7 and Chapter Extension 10 present collaboration techniques and collaboration information systems, respectively. Each chapter also includes a collaboration exercise at the end of the chapter.

Additionally, Pearson Education is sponsoring Microsoft SharePoint for student use. At your request, Pearson will set up a SharePoint site collection that your students can use when responding to the collaboration exercises at the end of each chapter. Students need nothing more than a browser to participate. See your Pearson sales representative for more information.

Opening Scenarios for Parts and Chapters

Each part and each chapter opens with a scenario intended to get students involved emotionally. We want students to mentally place themselves in the situation and to realize that this situation—or something like it—could happen to them. Each scenario sets up the chapter's content and provides an obvious example of why the chapter is relevant to

them. These scenarios help support the goals of student motivation and learning transfer.

Furthermore, both of these introductory cases involve the application of new technology to existing businesses. Our goal is to provide opportunities for students to see and understand how businesses are affected by new technology and how they need to adapt while, we hope, providing numerous avenues for you to explore such adaptation with your students.

In developing these scenarios, we endeavor to create business situations rich enough to realistically carry the discussions of information systems while at the same time simple enough that students with little business knowledge and even less business experience can understand. We also attempt to create scenarios that will be interesting to teach. This edition introduces the new eHermes case and continues the ARES case from the eighth edition.

eHermes

The chapters in Parts 1 and 2 are introduced with dialogue from key players at eHermes, a privately owned company that provides mobile shopping experiences using self-driving vehicles. We wanted to develop the case around an interesting business model that students would want to learn more about. Self-driving vehicles get a lot of attention in the press, but students may not know a lot about how they're used in business. Self-driving vehicles are on the road now. They should see widespread adoption in the next several years. It's likely that students will own or use a self-driving vehicle in the near future.

eHermes is considering strengthening its competitive advantage by using some type of artificial intelligence (AI) or machine learning to increase the efficiency of the fleet. However, were the company to do so, it would require a considerable capital investment. They would also need to hire a team of AI experts, develop new business processes, and modify their internal information systems. All of this is good fodder for Chapter 2 and for underlining the importance of the ways that IS needs to support evolving business strategy.

Ultimately, eHermes determines that it does not want to invest in an AI. It would be too costly, and they want to use their capital to grow other parts of their business. The company doesn't have enough reliable data to train the AI, and they'd need to invest more in additional infrastructure. eHermes decides to focus on its core strength of selling items through their mobile storefronts.

Students may object that, in studying eHermes, they devoted considerable time to an opportunity that ultimately didn't make business sense and was rejected. But this outcome is at least as informative as a successful outcome. The example uses knowledge of processes as well as application of business intelligence to avoid making a serious blunder and wasting substantial money. eHermes didn't have to hire a dozen AI experts, buy new infrastructure, and build a complex AI just to find out it would be a mistake. It could try to make a prototype, analyze the costs and benefits, and then avoid making the mistake in the first place. The very best way to solve a problem is not to have it!!

ARES

The Augmented Reality Exercise System (ARES) is an embryonic entrepreneurial opportunity that uses digital reality devices (Microsoft HoloLens), data-gathering exercise equipment, and the cloud to share integrated data among users, health clubs, and employers. ARES allows users to virtually bike with friends, famous cyclists, or even "pacers" mimicking their previous performance.

ARES is based on a real-world prototype developed for the owner of a health club who wanted to connect the workout data of his club members to their workout data at home and to their employers, insurance companies, and healthcare professionals. The prototype was written in C#, and the code runs against an Azure database in the cloud. It used the Windows Phone emulator that is part of Visual Studio.

As reflected in the ARES case, the developers realized it was unlikely to succeed because Dr. Flores was too busy as a cardiac surgeon to make his startup a success. Therefore, he sold it to a successful businessman who changed the staff and the strategy and repurposed the software to take advantage of new digital reality hardware. All of this is described at the start of Chapter 7.

Use of the Categorical Imperative and Utilitarianism in Ethics Guides

Since the introduction of the Ethics Guides into the first edition of this text, we believe there was a shift in students' attitudes about ethics. Students, at least many of them, seem to be more cynical and callous about ethical issues.

As a result, in the fifth edition, we began to use Kant's categorical imperative and Bentham and Mill's utilitarianism to ask students, whose ethical standards are often immature, to adopt the categorical imperative and utilitarian perspectives rather than their own perspectives and, in some cases, in addition to their own perspectives. By doing so, the students are asked to "try on" those criteria, and we hope in the process they think more deeply about ethical principles than they do when we allow them simply to apply their personal biases.

The Ethics Guide in Chapter 1 introduces the categorical imperative, and the guide in Chapter 2 introduces utilitarianism. If you choose to use these perspectives, you will need to assign both of those guides.

Modular Design

Not every MIS class is the same, and even though most MIS professors would agree on the basic content of this class, each professor has his or her own interests, expertise, and emphasis. Further, courses differ not only because of student and professor interests, but also because of the local employment environment, the grade level at which the class is taught, the background and educational maturity of students, and so on.

To support such specialization, the text is organized into short chapters and optional chapter extensions. Each of the 12 short chapters describes the minimum essentials of a topic. Additional material is then presented in 18 optional chapter extensions. Thus, for example, Chapter 3 addresses the basic ideas and purpose of business intelligence. That chapter is then supported by three chapter extensions: one on artificial intelligence, one on data mining, and one on reporting and OLAP.

You can pick the extensions that relate to your class's interests and needs, or you can use just the chapter itself and skip the extensions without loss of continuity. For a more specific description of how the book is organized, see the section titled "How Is the Content Organized?"

Guides

This book contains boxed essays called "guides" that amplify each chapter's core material. These features have two purposes. First, the Career Guides are intended to give students a glimpse at real-world information systems jobs. Each career guide focuses on the relevant chapter material and was written by an MIS graduate that works in that field. These guides help students think about the relevance of the chapter material to their future careers as businesspeople and, possibly, to encourage them to consider a career in MIS.

The second purpose of these guides is to encourage students to address the unique ethical issues that arise from using information systems. Use of the Ethics Guides will expose students to some of the fundamental principles relating to the combination of ethics, information systems, and business in general. All of the guides encourage students to grapple with some idea and its application to them either now or as future business professionals. Working with the guides should help students transfer knowledge from their MIS class to other classes and eventually to their business careers.

Integration of Excel and Access

Most MIS courses today include some use of Microsoft Office. Usually, professors adopt a main MIS book and then select another book for Office instruction. The result is an expensive package for the student to buy and a schizophrenic break between the "principles" text and the "applications" text.

To eliminate these problems, this text includes four chapter extensions on Microsoft Excel and Microsoft Access. Chapter Extension 1 teaches the fundamentals of Excel. Chapter Extension 6 teaches database design, and Chapter Extension 7 shows how to apply the principles of database design using Microsoft Access. Finally, Chapter Extension 8 discusses the use of Excel and Access together. Data are passed back and forth between those products so that students can compare and contrast Excel and Access features and strengths. Also, students learn practical skills for managing real data.

Most students should be able to learn (or review) fundamental Excel and Access skills with no supplemental text. Students who need extra instruction can, of course, find it in one of the many excellent tutorials. But having that material in this text means that most students need not buy another book. Those exercises are consolidated into one list, starting on page 621.

How Is the Content Organized?

The text is organized into four parts. See the brief contents on pages ix–x of the front matter for a presentation of the parts and chapters and of the relationship of the chapter extensions to the parts and chapters.

Part 1, "Why MIS?," introduces MIS and explains why and how it is important for business students. The three chapters in Part 1 address basic MIS definitions and the five-component framework, explain the role of IS in support of organizational strategy and competitive advantage, and look at business intelligence systems. Chapter extensions for Part 1 look at the basics of Excel, artificial intelligence, database marketing, and reporting systems and OLAP.

Part 2, "Information Technology," addresses fundamental IT concepts. The three chapters in Part 2 discuss hardware and software, database processing, and data communication. Chapter Extension 5 describes the development of Web and native mobile applications and describes an array of bring your own device (BYOD) policies. The next four chapter extensions teach the basics of Access, describe database design techniques, and show how to use Excel and Access together. Finally, Chapter Extension 9 discusses data communication technology that supports the cloud with particular focus on SOA and Web service standards.

Part 3 is titled "Using IS for Competitive Advantage." The three chapters in this part consider collaboration information systems, organization and systems, and social media. Part 3 chapter extensions present information on collaboration systems, systems for ERP, supply chain management, and enterprise social networks.

Part 4, "Information Systems Management," concludes the text with three chapters that address information

systems security, IS management including outsourcing, and systems development. Note that due to the increased importance of security, that chapter is the first chapter in this part. Part 4 chapter extensions include a detailed description of data breaches, discussions of international MIS, systems development project management, agile systems development with scrum, and business process management.

Again, the goal of the modular organization of this text is to allow you to pick and choose among those topics that best fit your needs. You will preserve continuity if you use each of the 12 chapters in sequence, but you need not use any of the chapter extensions if time is short.

Instructor Resources

At the Instructor Resource Center, *www.pearsonhighered.com/irc*, instructors can easily register to gain access to a variety of instructor resources available with this text in downloadable format. If assistance is needed, our dedicated technical support team is ready to help with the media supplements that accompany this text. Visit *http://247.pearsoned.com* for answers to frequently asked questions and toll-free user support phone numbers.

The following supplements are available with this text:

- Test Bank
- TestGen® Computerized Test Bank
- PowerPoint Presentation

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Randy Boyle

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David Kroenke has many years of teaching experience at Colorado State University, Seattle University, and the University of Washington. He has led dozens of seminars for college professors on the teaching of information systems and technology; in 1991, the International Association of Information Systems named him Computer Educator of the Year. In 2009, David was named Educator of the Year by the Association of Information Technology Professionals-Education Special Interest Group (AITP-EDSIG).

David worked for the U.S. Air Force and Boeing Computer Services. He was a principal in the startup of three companies, serving as the vice president of product marketing and development for the Microrim Corporation and as chief of database technologies for Wall Data, Inc. He is the father of the semantic object data model. David's consulting clients have included IBM, Microsoft, and Computer Sciences Corporation, as well as numerous smaller companies. Recently, David has focused on using information systems for teaching collaboration and teamwork.

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His research areas include deception detection in computer-mediated environments, secure information systems, the effects of IT on cognitive biases, the effects of IT on knowledge workers, and e-commerce. He has published in several academic journals and has authored additional textbooks, including *Using MIS*, 11th ed., *Corporate Computer and Network Security*, 4th ed., *Applied Information Security*, 2nd ed., and *Applied Networking Labs*, 2nd ed.

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PART 1
Why MIS?

eHermes is a 5-year-old, privately owned company that provides mobile shopping experiences using self-driving vehicles. Essentially, it's eBay on wheels that brings a mobile storefront right to your door. eHermes acts as a local classified broker that sells both used and new items. Its mobile storefronts pick up items customers want to sell and drop off items customers want to buy. Each of eHermes'mobile storefronts, which look like futuristic transparent shipping containers, can hold hundreds of different items.

SOURCE: Haiyin Wang/Alamy stock photo

eHermes mobile storefronts allow customers to physically inspect hundreds of similar items without having to meet sellers in person. Customers love this feature, and they often end up buying several items when the storefront stops in front of their house. eHermes charges a fee to put items up for sale for a set amount of time and receives a commission on each item purchased. The company also makes a moderate amount of ad revenue from its Web site and mobile app.

eHermes' CEO and cofounder is Jessica Ramma, a former VP at a midsized venture capital (VC) firm in California. Jessica got her MBA from the University of Chicago and immediately went to work analyzing high-tech startups for the VC firm. She quickly rose within the firm and made vice president in 8 years. Along the way, she developed a large network of highly skilled engineers and angel investors.

While investigating a startup, she met Victor Vazquez. At the time, Victor was managing a small artificial intelligence startup that was working on a groundbreaking vision system. Victor was charming, intelligent, and wealthy and had already run several successful startups. He had the uncanny ability to know which companies were going to be successful, and he could effectively work with the founders to grow their companies quickly.

Jessica asked Victor about the practical applications of his company's vision system, and he kept coming back to its potential use in self-driving vehicles. Victor explained that self-driving vehicles can see better than human drivers and can react much more quickly if something goes wrong. The conversation then shifted to a broader discussion of the impact of self-driving vehicles. Jessica was convinced of the inevitability of widespread self-driving vehicle adoption and wondered how this might affect existing business models. In fact, a friend of hers, Kamala Patel, had developed some of the first inter-vehicle protocols used to send information between vehicles. Kamala was passionate about automation and believed self-driving vehicles would affect nearly every industry. Jessica asked Victor if he would have lunch with her and Kamala the following week. She had an idea.

SOURCE: Andrey Suslov/Shutterstock

At the lunch, Jessica pitched Victor and Kamala the eHermes idea, and the company was born a few months later. Fast-forward 5 years. eHermes now has several dozen mobile storefronts with revenues of about $8 million per year. As the CEO, Jessica wants to grow the company more quickly by providing mobile storefronts to traditional companies like Walmart and local grocery stores as well as ecommerce retailers like Amazon. Victor is worried that the company is not ready. It's been a bumpy ride just to get the existing mobile storefronts working correctly.

Designing, building, and testing the storefronts have been expensive and, at times, frustrating. Creating the inventory tracking system was more complicated than initially thought. The routing, coordination, and optimization of the storefronts have been a nightmare, too. Inefficient routes increase fuel consumption, which has a big impact on the company's bottom line. And then there's the hugely expensive systems development project that's currently under way to automate the collection, storage, and analysis of storefront data. Currently, everything is recorded manually by sales associates who ride inside each storefront. Any new inventory is brought back to the warehouse, where it's photographed and entered into the online system.

Victor feels like they should wait to expand the business. The company doesn't have the money or the people to start a major expansion like the one Jessica is thinking about. But customers love buying from eHermes, and sales projections look promising. The company has gotten a lot of positive press lately, and investors are more than willing to throw money into the company.

Jessica also mentioned that they should explore the possibility of using some type of artificial intelligence (AI) or machine learning to increase the efficiency of the fleet. Coordinating all of the sales stops, inventory pickups, mobile storefront stocking, travel routes, charging and fueling times, and maintenance schedules is incredibly complex. The current system is working OK, but it's not optimal. And it's hurting eHermes financially. They need a fully integrated solution.

Chapter 1
The Importance of MIS

"Fired? You're firing me?"

"Well, *fired* is a harsh word, but . . . well, eHermes has no further need of your services."

"But, Victor, I don't get it. I really don't. I worked hard, and I did everything you told me to do."

"Amanda, that's just it. You did everything *I* told you to do."

"I put in so many hours. How could you fire me?"

"Your job was to find ways to reduce our costs using AI or machine learning."

"Right! And I did that."

"No, you didn't. You followed up on ideas *that I gave you*. But we don't need someone who can follow up on my plans. We need someone who can figure out what we need to do, create her own plans, and bring them back to me . . . and others."

"How could you expect me to do that? I've only been here 6 months!"

"It's called teamwork. Sure, you're just learning our business, but I made sure all of our senior staff would be available to you . . ."

"I didn't want to bother them."

"Well, you succeeded. I asked Kamala what she thought of the plans you're working on. 'Who's Amanda?' she asked."

"But doesn't she work down at the warehouse hub?"

"Right. She's in charge of operations . . . and it would seem to be worth talking to her."

"I'll go do that!"

"Amanda, do you see what just happened? I gave you an idea, and you said you'd do it. That's not what I need. I need you to find solutions on your own."

"I worked really hard. I put in a lot of hours. I've got all these reports written."

"Has anyone seen them?"

"I talked to you about some of them. But I was waiting until I was satisfied with them."

MyLab MIS

- End of Chapter Questions 1-1, 1-2, 1-3
- Excel and Access Application Questions 1-1 and 1-2

"Right. That's not how we do things here. We develop ideas and then kick them around with each other. Nobody has all the smarts. Our plans get better when we comment and rework them. . . I think I told you that."

"Maybe you did. But I'm just not comfortable with that."

"Well, it's a key skill here."

"I know I can do this job."

"Amanda, you've been here almost 6 months; you have a degree in business and information systems. Several weeks ago, I asked you for your first idea for a process that would identify which AIs or machine learning processes could be used to reduce costs and increase efficiency. Do you remember what you said?"

"Yes, I wasn't sure how to proceed. I didn't want to just throw something out that might not work."

"But how would you find out if it would work?"

"I don't want to waste money . . ."

"No, you don't. So, when you didn't get very far with that task, I backed up and asked you to send me a list of companies that are currently using AIs and machine learning. I wanted to know what *types* of problems they're solving, the magnitude of efficiency gains they're realizing, how long it took to implement these systems, and a basic description of how they might be used in our company. Not details, just an overview."

"Yes, I sent you those lists and descriptions."

"Amanda, they made no sense. Your lists included companies that use AI vision systems and natural language processing systems, and your description of how AI could be used at eHermes was focused on robotics."

"I know they can be used for planning and optimization too, I just didn't include it in the material I sent you. But I'll try again!"

"Well, I appreciate that attitude, but we're a small company, really still a startup in many ways. Everyone needs to pull more than their own weight here. Maybe if we were a bigger company, I'd be able to find for a spot for you, see if we could bring you along. But we can't afford to do that now."

"What about my references?"

"I'll be happy to tell anyone that you're reliable, that you work 40 to 45 hours a week, and that you're honest and have integrity."

"Those are important!"

"Yes, they are. But today, they're not enough."

"But today, they're not enough."

SOURCE: Haiyin Wang/Alamy Stock Photo

Chapter Learning Objective Questions

1-1 Why Is Introduction to MIS the Most Important Class in the Business School?

1-2 How Will MIS Affect Me?

1-3 Why Are MIS-Related Jobs in High Demand?

1-4 What Is MIS?

1-5 What Is Information?

1-6 What Data Characteristics Are Necessary for Quality Information?

How does the **knowledge** in this chapter help **you**?

CE

Optional Extension for this chapter is • CE1: Introduction to Microsoft Excel 2019 347

1-1 Why Is Introduction to MIS the Most Important Class in the Business School?

Introduction to MIS is the most important class in the business school. This wasn't always the case. A couple decades ago, majoring in "computers" was considered a nerdy thing do to. But things have changed—a lot. Now the hottest jobs are found in tech companies. People brag about working for tech startups. Microsoft Corp. is the largest corporation in the world with a market cap of $967B. The largest IPO offering in history ($25B) came from the online ecommerce giant Alibaba (Alibaba Holdings Group) in 2014.

But why? Why has information technology changed from a minor corporate support function to a primary driver of corporate profitability? Why are tech jobs some of the highest paid? Why is working for a tech company considered über cool?

The answer has to do with the way technology is fundamentally changing business.

The Digital Revolution

You've probably heard that we live in the **Information Age**, or a period in history where the production, distribution, and control of information are the primary drivers of the economy. The Information Age started in the 1970s with the **Digital Revolution**, or the conversion from mechanical and analog devices to digital devices. This shift to digital devices meant monumental changes for companies, individuals, and our society as a whole.

The problem was people couldn't really understand how, or even why, this shift was going to affect them. Much like people today, they based their future projections on past events. They knew factories, bureaucracies, mass production, and operational efficiency. But this knowledge didn't prepare them for the changes that were coming.

The Digital Revolution didn't just mean that new "digital" equipment was replacing old mechanical, or analog, equipment. These new digital devices could now be connected to other digital devices and share data among themselves. They could also work faster as processor speed increased. This was groundbreaking. In 1972, computer scientist Gordon Bell recognized that these digital devices would change the world as they evolved and became widely used. He formulated **Bell's Law**, which states that "a new computer class forms roughly each decade establishing a new industry."[1] In other words, digital devices will evolve so quickly that they will enable new platforms, programming environments, industries, networks, and information systems every 10 years.

And it has happened just as Bell predicted. About every 10 years since 1970, entirely new classes of digital devices have emerged. They have created entirely new industries, companies, and platforms. In the 1980s, we saw the rise of the personal computer (PC) and small local networks. In the 1990s, we saw the rise of the Internet and widespread adoption of cellular phones. In the 2000s, we saw a push toward making all "things" network-enabled. Social networking and cloud-based services really took off, creating a flurry of new companies. In the 2010s, so far, we've seen huge advances in artificial intelligence, 3D printing, digital reality devices (e.g., Microsoft Hololens), self-driving vehicles, and cryptocurrencies.

The evolution of digital technology has fundamentally altered businesses and become a primary driver of corporate profitability. And it will probably continue to do so for at least the next few decades. The key to understanding how businesses will be affected by this digital evolution is understanding the forces pushing the evolution of these new digital devices.

Evolving Capabilities

To understand the fundamental forces pushing the evolution of digital devices, let's imagine your body is evolving at the same rate as digital devices. Suppose you can run 8 miles per hour today. That's about average. Now suppose, hypothetically, that your body is changing so quickly that you can run twice as fast every 18 months. In 18 months, you'd be able to run 16 mph. In another 18 months, you'd be at 32 mph. Then 64, 128, 256, and 512. Then, after 10 1/2 years of growth, you'd be running 1,024 mph—on foot! How would this change your life?

Well, you'd certainly give up your car. It would be much too slow. Air travel would also probably be a thing of the past. You could start a very profitable package delivery business and quickly corner the market. You could live outside the city because your commute would be shorter. You'd also need new clothes and some really tough shoes! And this is the key point—not only would *you* change, but *what* you do and *how* you do it would also change. This is Bell's Law. This same thing is happening to digital devices.

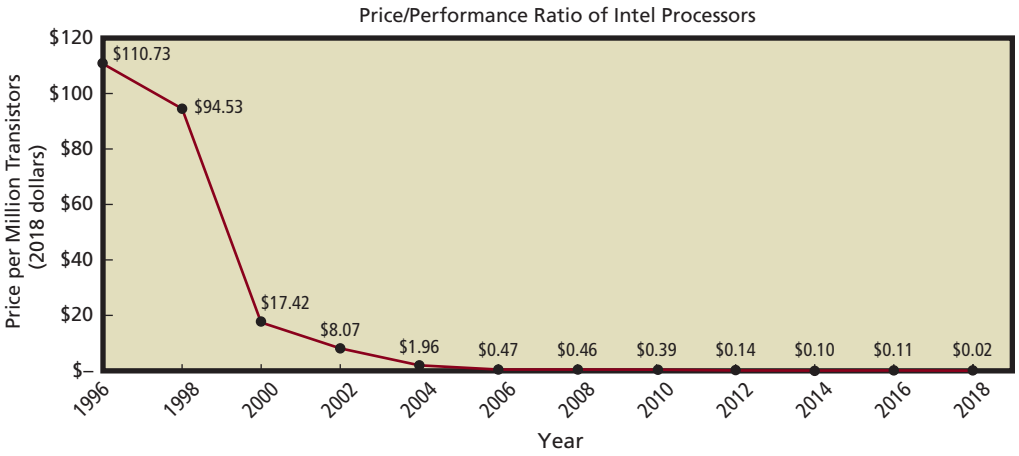
This example may seem silly at first, but it helps you understand how exponential change is affecting digital devices. Processing power, interconnectivity of devices, storage capacity, and bandwidth are all increasing extremely rapidly—so rapidly that it's changing how these devices are used. Let's explore some of these forces by looking at the laws that describe them.

Moore's Law

In 1965, Gordon Moore, cofounder of Intel Corporation, stated that because of technology improvements in electronic chip design and manufacturing, "the number of transistors per square inch on an integrated chip doubles every 18 months." This became known as **Moore's Law**. His statement has been commonly misunderstood to be "the speed of a computer doubles every 18 months," which is incorrect but captures the sense of his principle.

Because of Moore's Law, the ratio of price to performance of computer processors has fallen dramatically. In 1996, when the Internet was really starting to take off, a standard CPU cost about $110 per million transistors. By 2018, that price had fallen to $0.02 per million transistors.[2] See Figure 1-1. Increasing processing power has had a greater impact on the global economy in the past 30 years than any other single factor. It has enabled new devices, applications, companies, and

Figure 1-1 Computer Price/Performance Ratio Decreases

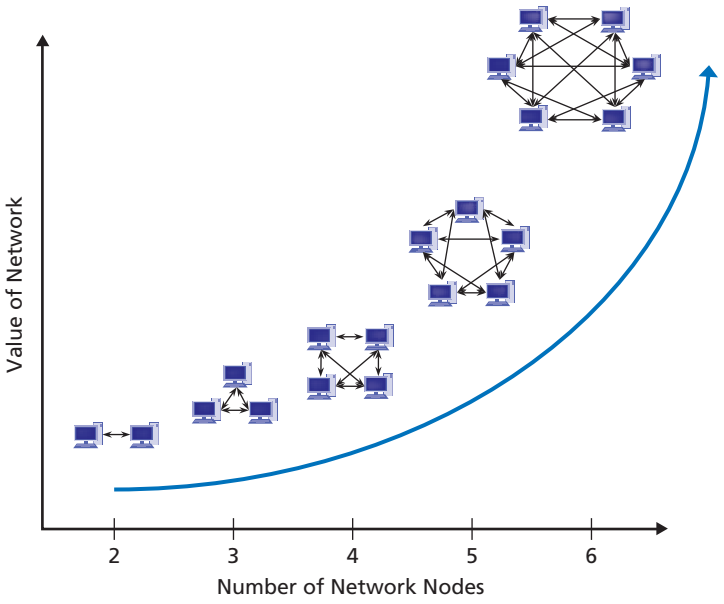


SOURCE: © Based on data from ark.intel.com#@Processors

platforms. In fact, most tech companies would not exist today if processing power hadn't increased exponentially.

As a future business professional, however, you needn't care how fast of a computer your company can buy for $1,000. That's not the point. The point is, because of Moore's Law, the cost of data processing is approaching zero. Current applications like new drug development, artificial intelligence, and molecular modeling require massive amounts of processing power. Innovations in these areas are being held back because the cost of buying sufficient processing power is so high. But the good news is that the cost of processing is dropping—rapidly.

Figure 1-2 Increasing Value of Networks



Metcalfe's Law

Another fundamental force that is changing digital devices is Metcalfe's Law, named after Robert Metcalfe, the inventor of Ethernet. **Metcalfe's Law** states that the value of a network is equal to the square of the number of users connected to it. In other words, as more digital devices are connected together, the value of that network will increase.[3] See Figure 1-2. Metcalfe's Law can be clearly seen in the dramatic rise of the Internet in the 1990s. As more users gained access to the Internet, it became more valuable. The dot-com boom ushered in tech giants like Google, Amazon, and eBay. None of these companies would have existed without large numbers of users connected to the Internet.

Metcalfe's Law isn't lost on tech companies, either. Google's Project Loon is a major effort to bring Internet access to everyone on the planet using a network of inflated balloons floating around the world. One of the primary metrics for social media companies is the number of monthly active users (MAU) using their social network. The more people they can get in their network, the more their company will be worth. And look at the network effects of using products like Microsoft Word. Why do you pay for Microsoft Word when you could use a free word processor like LibreOffice Writer? You pay for Microsoft Word because everyone else uses it.

Other Forces Pushing Digital Change

And it's not just the number of users on the network that's changing the way we use digital devices—it's the *speed* of the network. **Nielsen's Law**, named after Jakob Nielsen, says that network connection speeds for high-end users will increase by 50 percent per year. As networks become faster, new companies, new products, and new platforms will emerge.

YouTube, for example, started in February 2005 when there wasn't a lot of video shared over the Internet. But average Internet speeds were increasing to the point where a typical Internet connection could handle a stream of YouTube videos. By November 2006, the company was bought by Google for $1.65B. If you're counting, that's less than 2 years to create a billion-dollar company. Network speed matters. The question is why didn't Google, Microsoft, IBM, or Apple think of video sharing before the YouTube founders?

There are other forces changing digital devices beyond Nielsen's Law, Metcalfe's Law, and Moore's Law (see Figure 1-3). **Kryder's Law**, named after Mark Kryder, the former chief technology officer of Seagate Corp., says that the storage density on magnetic

Figure 1-3 Fundamental Forces Changing Technology

Law	Meaning	Implications
Moore's Law	The number of transistors per square inch on an integrated chip doubles every 18 months.	Computers are getting exponentially faster. The cost of data processing is approaching zero.
Metcalfe's Law	The value of a network is equal to the square of the number of users connected to it.	More digital devices are connected together. The value of digital and social networks is increasing exponentially.
Nielsen's Law	Network connection speeds for high-end users will increase by 50 percent per year.	Network speed is increasing. Higher speeds enable new products, platforms, and companies.
Kryder's Law	The storage density on magnetic disks is increasing at an exponential rate.	Storage capacity is increasing exponentially. The cost of storing data is approaching zero.

disks is increasing at an exponential rate (see Figure 1-4). Digital storage is so important that it's typically the first question you ask when you buy a new computer, smartphone, or tablet. There are also power consumption, image resolution, and interconnectivity between devices, all of which are changing, too. And this isn't a complete list.

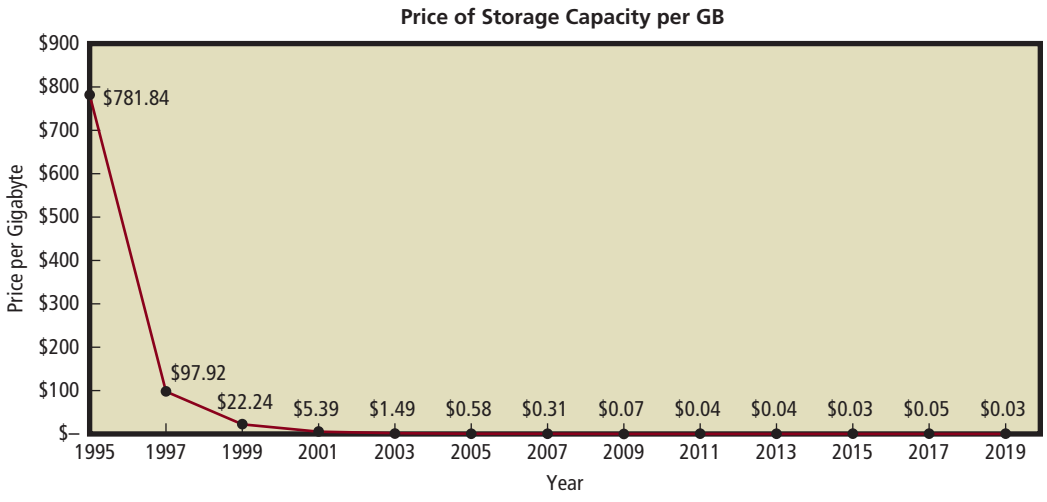
This Is the Most Important Class in the School of Business

This takes us back to our original statement that Introduction to MIS is the most important class you will take in the school of business. Why? Because this class will show you how technology is fundamentally changing businesses. You'll learn why executives are constantly trying to find ways to use new technology to create a sustainable competitive advantage. This leads us to the first reason Introduction to MIS is the most important course in the business school today:

Future business professionals need to be able to assess, evaluate, and apply emerging information technology to business.

You need the knowledge of this course to attain that skill.

Figure 1-4 Price of Storage Capacity per GB



1-2 How Will MIS Affect Me?

Technological change is accelerating. So what? How is this going to affect you? You may think that the evolution of technology is just great. You can hardly wait for the next iGadget to come out.

But pause for a second and imagine you graduated from college in 2004 and went to work for one of the largest and most successful home entertainment companies in the United States—Blockbuster LLC. In 2004, Blockbuster had 60,000 employees and 9,000-plus stores with $5.9B in annual revenues. Everything looked peachy. Fast-forward 6 years to 2010 and Blockbuster was bankrupt! Why? Because streaming a video over the Internet is easier than driving to a store. High-speed Internet connections made it all possible.

The point is that after graduation you too may choose to go to work for a large, successful, well-branded company. And 6 years down the road, it could be bankrupt because technology changed and it didn't.

How Can I Attain Job Security?

Many years ago, I had a wise and experienced mentor. One day I asked him about job security, and he told me that the only job security that exists is "a marketable skill and the courage to use it." He continued, "There is no security in our company, there is no security in any government program, there is no security in your investments, and there is no security in Social Security." Alas, how right he turned out to be.

So, what is a marketable skill? It used to be that one could name particular skills, such as computer programming, tax accounting, or marketing. But today, because of Moore's Law, Metcalfe's Law, and Kryder's Law, the cost of data processing, storage, and communications is essentially zero. Any routine skill can and will be outsourced to the lowest bidder. And if you live in the United States, Canada, Australia, Europe, or another advanced economy, the lowest bidder is unlikely to be you.

Numerous organizations and experts have studied the question of what skills will be marketable during your career. Consider two of them. First, the RAND Corporation, a think tank located in Santa Monica, California, has published innovative and groundbreaking ideas for more than 70 years, including the initial design for the Internet. In 2004, RAND published a description of the skills that workers in the 21st century will need:

> Rapid technological change and increased international competition place the spotlight on the skills and preparation of the workforce, particularly the ability to adapt to changing technology and shifting demand. Shifts in the nature of organizations . . . favor strong nonroutine cognitive skills.[4]

Whether you're majoring in accounting, marketing, finance, or information systems, you need to develop strong nonroutine cognitive skills.

What are such skills? Robert Reich, former secretary of labor, enumerates four:[5]

- Abstract reasoning
- Systems thinking
- Collaboration
- Ability to experiment

Figure 1-5 shows an example of each. Reread the eHermes case that started this chapter, and you'll see that Amanda lost her job because of her inability to practice these key skills. Even though Reich's book was written in the early 1990s, the cognitive skills he mentions are still relevant today because humans, unlike technology, aren't changing that rapidly.[6]

How Can Intro to MIS Help You Learn Nonroutine Skills?

Introduction to MIS is the best course in the business school for learning Reich's four key skills because every topic requires you to apply and practice them. Here's how.

Figure 1-5 Examples of Critical Skills for Nonroutine Cognition

Skill	Example	Amanda's Problem at eHermes
Abstract Reasoning	Construct a model or representation.	Hesitancy and uncertainty when conceptualizing a method for using AI and machine learning.
Systems Thinking	Model system components and show how components' inputs and outputs relate to one another.	Inability to model eHermes operational needs.
Collaboration	Develop ideas and plans with others. Provide and receive critical feedback.	Unwilling to work with others on work-in-progress.
Ability to Experiment	Create and test promising new alternatives, consistent with available resources.	Fear of failure prohibited discussion of new ideas.

Abstract Reasoning **Abstract reasoning** is the ability to make and manipulate models. You will work with one or more models in every course topic and book chapter. For example, later in this chapter you will learn about a *model* of the five components of an information system. This chapter will describe how to use this model to assess the scope of any new information system project; other chapters will build upon this model.

In this course, you will not just manipulate models that we have developed, you will also be asked to construct models of your own. In Chapter 5, for example, you'll learn how to create data models, and in Chapter 12 you'll learn to make process models.

Systems Thinking Can you go to a grocery store, look at a can of green beans, and connect that can to U.S. immigration policy? Can you watch tractors dig up a forest of pulpwood trees and connect that woody trash to Moore's Law? Do you know why Cisco Systems is one of the major beneficiaries of YouTube? Answers to all of these questions require systems thinking. **Systems thinking** is the ability to model the components of the system to connect the inputs and outputs among those components into a sensible whole that reflects the structure and dynamics of the phenomenon observed.

As you are about to learn, this class is about information *systems.* We will discuss and illustrate systems; you will be asked to critique systems; you will be asked to compare alternative systems; you will be asked to apply different systems to different situations. All of those tasks will prepare you for systems thinking as a professional.

Collaboration **Collaboration** is the activity of two or more people working together to achieve a common goal, result, or work product. Chapter 7 and Chapter Extension 2 will teach you collaboration skills and illustrate several sample collaboration information systems. Every chapter of this book includes collaboration exercises that you may be assigned in class or as homework.

Here's a fact that surprises many students: Effective collaboration isn't about being nice. In fact, surveys indicate the single most important skill for effective collaboration is to give and receive critical feedback. Advance a proposal in business that challenges the cherished program of the VP of marketing, and you'll quickly learn that effective collaboration skills differ from party manners at the neighborhood barbecue. So, how do you advance your idea in the face of the VP's resistance? And without losing your job? In this course, you can learn both skills and information systems for such collaboration. Even better, you will have many opportunities to practice them.

Ability to Experiment

"I've never done this before."
"I don't know how to do it."
"But will it work?"
"Is it too weird for the market?"

Fear of failure: the fear that paralyzes so many good people and so many good ideas. In the days when business was stable, when new ideas were just different verses of the same song, professionals could allow themselves to be limited by fear of failure.

Let's look at an example of the application of social networking to the oil change business. Is there a legitimate application of social networking there? If so, has anyone ever done it? Is there anyone in the world who can tell you what to do? How to proceed? No. As Reich says, professionals in the 21st century need to be able to experiment.

Successful experimentation is not throwing buckets of money at every crazy idea that enters your head. Instead, **experimentation** is making a reasoned analysis of an opportunity, envisioning potential solutions, evaluating those possibilities, and developing the most promising ones consistent with the resources you have.

In this course, you will be asked to use products with which you have no familiarity. Those products might be Microsoft Excel or Access, or they might be features and functions of Blackboard that you have not used. Or you may be asked to collaborate using OneDrive or SharePoint or Google Drive. Will your instructor explain and show every feature of those products that you'll need? You should hope not. You should hope your instructor will leave it up to you to experiment, to envision new possibilities on your own, and to experiment with those possibilities, consistent with the time you have available.

1-3 Why Are MIS-Related Jobs in High Demand?

Employment is another factor that makes the Introduction to MIS course vitally important to you. Accenture, a technology consulting and outsourcing company, conducted a survey of CEOs in 2018. It found that 74 percent of CEOs plan to use artificial intelligence (AI) to automate tasks to a large or very large extent over the next 3 years. But those same CEOs also believe that only 26 percent of their workers are prepared to collaborate with their AI coworkers. Even worse, only 3 percent of CEOs plan on increasing investments toward training and reskilling employees to prepare them for these new tech-centric jobs.[7] Understanding technology and having a willingness to learn new tech skills will be an increasingly important part of staying gainfully employed in the future. You will learn more about intelligent systems, including AI, in Chapter 3 and Chapter Extension 2.

The demand for information systems and business jobs is high and driving future wage growth. According to data from the U.S. Bureau of Labor Statistics, shown in Figure 1-6, the top five occupational categories with the highest median wages in 2018 were management, computer and mathematical, legal, architecture and engineering, and business and financial operations. Projected job growth in computer and mathematical jobs (13.7 percent) was nearly double the average for all occupations (7.4 percent). The mismatch between the high level of tech skills demanded by employers and the low level of tech skills held by employees is known as the **technology skills gap**.

Figure 1-7 shows a more detailed breakdown of salary growth from 2012 to 2016 for specific subcategories under business managers, computer and information technology, and other business occupations. It also shows job growth projections for the years 2016 to 2026.[8] The average growth rate for information systems–related jobs (14 percent) is twice that of the average for all occupations (7 percent).

Figure 1-6 Median Wage and Percent Job Growth by Sector

Occupations	2017 Median Wage	2018 Median Wage	2016–26 Percent Job Growth
Management	$ 102,590	$ 104,240	8.5
Computer and mathematical	$ 84,560	$ 86,340	13.7
Legal	$ 80,080	$ 80,810	9.1
Architecture and engineering	$ 79,180	$ 80,170	7.5
Business and financial operations	$ 67,710	$ 68,350	9.6
Healthcare practitioners and technical	$ 64,770	$ 66,440	15.3
Life, physical, and social science	$ 64,510	$ 66,070	9.6
Education, training, and library	$ 48,740	$ 49,700	9.4
Arts, design, entertainment, sports, and media	$ 48,230	$ 49,290	6.1
Construction and extraction	$ 44,730	$ 46,010	11.0
Installation, maintenance, and repair	$ 44,520	$ 45,540	6.6
Community and social service	$ 43,840	$ 44,960	14.5
Protective service	$ 39,550	$ 40,640	4.5
All occupations	$ 37,690	$ 38,640	7.4
Office and administrative support	$ 34,740	$ 35,760	0.6
Production	$ 33,990	$ 35,070	−4.3
Transportation and material moving	$ 31,600	$ 32,730	6.2
Healthcare support	$ 28,710	$ 29,740	23.6
Sales and related	$ 27,020	$ 28,180	2.9
Building and grounds cleaning and maintenance	$ 25,620	$ 26,840	9.3
Farming, fishing, and forestry	$ 24,390	$ 25,380	−0.3
Personal care and service	$ 23,610	$ 24,420	19.1
Food preparation and serving related	$ 21,910	$ 23,070	9.3

SOURCE: Employment Projections program, U.S. Bureau of Labor Statistics

Figure 1-7 Bureau of Labor Statistics Occupational Outlook 2016–2026

	2014 Median Pay	2016 Median Pay	2018 Median Pay	Job Growth (%) 2016–26	Job Growth (N) 2016–26
Business Managers					
Marketing Managers	$ 123,450	$ 127,560	$ 132,620	10%	23,800
Information Systems Managers	$ 127,640	$ 135,800	$ 142,530	12%	44,200
Financial Managers	$ 115,320	$ 121,750	$ 127,990	19%	108,600
Human Resources Managers	$ 102,780	$ 106,910	$ 113,300	9%	12,300
Sales Managers	$ 110,660	$ 117,960	$ 124,220	7%	28,900
Computer and InformationTechnology					
Computer Network Architects	$ 98,430	$ 101,210	$ 109,020	6%	10,500
Computer Systems Analysts	$ 82,710	$ 87,220	$ 88,740	9%	54,400
Database Administrators	$ 80,280	$ 84,950	$ 90,070	11%	13,700
Information Security Analysts	$ 88,890	$ 92,600	$ 98,350	28%	28,500
Network and Systems Admin.	$ 75,790	$ 79,700	$ 82,050	6%	2,400
Software Developers	$ 97,990	$ 102,280	$ 105,590	24%	302,500
Web Developers	$ 63,490	$ 66,130	$ 69,430	15%	24,400
Business Occupations					
Accountants and Auditors	$ 65,940	$ 68,150	$ 70,500	10%	139,900
Financial Analysts	$ 78,620	$ 81,760	$ 85,660	11%	32,200
Management Analysts	$ 80,880	$ 81,330	$ 83,610	14%	115,200
Market Research Analysts	$ 61,290	$ 62,560	$ 63,120	23%	138,300
Logisticians	$ 73,870	$ 74,170	$ 74,600	7%	10,300
Human Resources Specialists	$ 57,420	$ 59,180	$ 60,880	7%	38,900

SOURCE: Bureau of Labor Statistics, "Computer Systems Analysts," Occupational Outlook Handbook, accessed May 26, 2019, www.bls.gov/ooh.

Information systems and computer technology provide job and wage benefits beyond just IS professionals. Acemoglu and Autor published an impressive empirical study of jobs and wages in the United States and parts of Europe from the 1960s to 2010. They found that early in this period, education and industry were the strongest determinants of employment and salary. However, since 1990, the most significant determinant of employment and salary is the nature of work performed. In short, as the price of computer technology plummets, the value of jobs that benefit from it increases dramatically.[9]

For example, plentiful, high-paying jobs are available to business professionals who know how to use information systems to improve business process quality, those who know how to interpret data mining results for improved marketing, or those who know how to use emerging technology like 3D printing to create new products and address new markets. See the Guide on pages 22–23 for more thoughts on why you might consider an IS-related job.

What Is the Bottom Line?

The bottom line? This course is the most important course in the business school because:

1. It will give you the background you need to assess, evaluate, and apply emerging information systems technology to business.
2. It can give you the ultimate in job security—marketable skills—by helping you learn abstraction, systems thinking, collaboration, and experimentation.
3. Many well-paid MIS-related jobs are in high demand.

The Ethics Guide in each chapter of this book considers the ethics of information system use. The guides challenge you to think deeply about how to apply ethical standards to unfamiliar situations. The Ethics Guide on pages 20–21 considers the ethics of using information that deceives the viewer.

1-4 What Is MIS?

We've used the term *MIS* several times, and you may be wondering exactly what it is. **MIS** stands for **management information systems**, which we define as *the management and use of information systems that help organizations achieve their strategies*. MIS is often confused with the closely related terms information technology and information systems. An **information system (IS)** is an assembly of hardware, software, data, procedures, and people that produces information. In contrast, **information technology (IT)** refers to the products, methods, inventions, and standards used for the purpose of producing information.

How are MIS, IS, and IT different? You cannot buy an IS. But you can buy IT; you can buy or lease hardware, you can license programs and databases, and you can even obtain predesigned procedures. Ultimately, however, it is *your* people who will assemble the IT you purchase and execute those procedures to employ that new IT. Information technology drives the development of new information systems.

For any new system, you will always have training tasks (and costs), you will always have the need to overcome employees' resistance to change, and you will always need to manage the employees as they use the new system. Hence, you can buy IT, but you cannot buy IS. Once your new information system is up and running, it must be managed and used effectively in order to achieve the organization's overall strategy. This is MIS.

Consider a simple example. Suppose your organization decides to develop a Facebook page. Facebook provides the IT. It provides the hardware and programs, the database structures, and standard procedures. You, however, must create the IS. You have to provide the data to fill your portion of its database, and you must extend its standard procedures with your own procedures for keeping that data current. Those procedures need to provide, for example, a means to review your page's content regularly and a means to remove content that is judged inappropriate. Furthermore, you need to train employees on how to follow those procedures and manage those employees to ensure that they do. MIS is the management of your Facebook page to

So What?

A Is for Alphabet

We are living in an era referred to as the Information Age, a period in human history characterized by the shift from an economy based on industrial production to one based on information and computerization.[10] This shift has changed virtually every aspect of our lives, from the way we communicate with friends, coworkers, and loved ones to the way we purchase goods and carry out various financial transactions. What advancement made this shift possible? You guessed it—the Internet!

As with most technological innovations, the Internet started out as a project sponsored by both research and governmental entities. It took several decades to lay the groundwork for the Internet as we know it today, and the tipping point for widespread Internet use was the introduction of Netscape Navigator, the Web browser of choice in the mid-1990s. The adoption and use of Netscape were critical because they allowed fledgling Internet users to access information posted by other users around the world. At that time, the content available on the Internet was minimal, and only tech-savvy users could create and manage content. Over time, the amount of information available became so great that new tools were needed to search the Internet. Enter Google.

Google Searches for a Better Future in Alphabet

Today, Google is the dominant Internet search engine and is one of the largest publicly traded companies in the world. What you may not realize is that Google's core search engine service (Google Search) is only one of many successful products in a larger portfolio. Google has turned Google Maps, YouTube, Chrome, and Android into successful standalone offerings. The success and diversity of Google's many projects led the company to announce that, as of August 10, 2015, it was a subsidiary of an overarching company named Alphabet Inc.[11]

Google founders Larry Page and Sergey Brin decided that it was time to reduce their involvement in the daily management of Google projects. To facilitate this change, each project was transitioned into a standalone company with its own CEO, and each standalone company is a subsidiary of Alphabet Inc. In this way, Page and Brin can manage the overall strategic objectives of the subsidiaries without having to immerse themselves in the daily operations of each company.

Why did they choose the name Alphabet? In a blog post about the new direction of the company, Page revealed that there are a number of meanings associated with this new name. First, an alphabet represents the collection of letters used to define a language, which Page classifies as one of humanity's most profound creations. Second, alphabets serve as the basis for Google searches around the world. Finally, in the world of finance, alpha represents an investment return above the benchmark, which, according to Page, is something the company is continuously striving to achieve.[12]

While Page's rationale about the restructuring makes sense, outsiders have identified this strategy as a direct response to Google's struggles to retain top talent in a highly competitive industry. Before restructuring, Google housed a wide variety of projects and research initiatives under one roof; this led to an increasingly bureaucratic climate and inherent limitations on the career trajectories of industry superstars.[13] Alphabet was born to create a new corporate environment in which top talent can thrive. In the Alphabet hierarchy, individual companies are much more nimble and better able to provide the autonomy and efficiency that smaller companies offer.

When future generations look back at the Information Age, it is likely Alphabet will be seen as playing a prominent role. With all of the projects the company is pursuing—everything from drones and robots to medical research and artificial intelligence—it is intriguing to think about the role Alphabet will play in shaping the next era of humanity.

Questions

1. The feature identifies the Internet as a catalyst for the Information Age. What other innovations have contributed to this era of unprecedented access to information via computers?
2. Think about your daily use of phones, tablets, and traditional desktop/laptop computers. How many searches do you perform each day? What types of things do you search for on the Internet? Do you use Google for these searches? If not, what search engine do you use? Why do you use that search engine?
3. Conduct an Internet search to find a project or product offered by Alphabet that you had not heard about before reading this feature. Are you surprised at the diversity of the company and its projects and research initiatives?
4. What technological innovation do you think will drive the next great era in humanity? What do you think the defining elements of that era will be?

achieve your organization's overall strategy. Managing your own Facebook page is as simple an IS as exists. Larger, more comprehensive IS that involve many, even dozens, of departments and thousands of employees require considerable work.

The definition of MIS has three key elements: *management and use*, *information systems*, and *strategies*. Let's consider each, starting first with information systems and their components.

Components of an Information System

A **system** is a group of components that interact to achieve some purpose. As you might guess, an *information system* (*IS*) is a group of components that interacts to produce information. That sentence, although true, raises another question: What are these components that interact to produce information?

Figure 1-8 shows the **five-component framework**—a model of the components of an information system: **computer hardware**, **software**, **data**, **procedures**, and **people**. These five components are present in every information system, from the simplest to the most complex. For example, when you use a computer to write a class report, you are using hardware (the computer, storage disk, keyboard, and monitor), software (Word, WordPerfect, or some other word-processing program), data (the words, sentences, and paragraphs in your report), procedures (the methods you use to start the program, enter your report, print it, and save and back up your file), and people (you).

Consider a more complex example, say, an airline reservation system. It, too, consists of these five components, even though each one is far more complicated. The hardware consists of thousands of computers linked together by data communications hardware. Hundreds of different programs coordinate communications among the computers, and still other programs perform the reservations and related services. Additionally, the system must store millions upon millions of characters of data about flights, customers, reservations, and other facts. Hundreds of different procedures are followed by airline personnel, travel agents, and customers. Finally, the information system includes people, not only the users of the system but also those who operate and service the computers, those who maintain the data, and those who support the networks of computers.

These five components also mean that building information systems requires many different skills besides those of hardware technicians or computer programmers. See the Career Guide on pages 22–23 for more.

The important point here is that the five components in Figure 1-8 are common to all information systems, from the smallest to the largest. As you think about any information system, including a new one like social networking, learn to look for these five components. Realize, too, that an information system is not just a computer and a program but rather an assembly of computers, programs, data, procedures, and people.

Before we move forward, note that we have defined an information system to include a computer. Some people would say that such a system is a **computer-based information system**. They would note that there are information systems that do not include computers, such as a calendar hanging on the wall outside a conference room that is used to schedule the room's use. Such systems have been used by businesses for centuries. Although this point is true, in this book we focus on computer-based information systems. To simplify and shorten the book, we will use the term *information system* as a synonym for *computer-based information system*.

Management and Use of Information Systems

The next element in our definition of MIS is the *management and use* of information systems. Here we define management to mean develop, maintain, and adapt. Information systems do not pop up like mushrooms after a hard rain; they must be developed. They must also be maintained, and, because business is dynamic, they must be adapted to new requirements.

You may be saying, "Wait a minute, I'm a finance (or accounting or management) major, not an information systems major. I don't need to know how to manage information systems." If you are saying that, you are like a lamb headed for shearing. Throughout your career, in whatever

Figure 1-8 Five Components of an Information System

field you choose, information systems will be built for your use and sometimes under your direction. To create an information system that meets your needs, you need to take an *active role* in that system's development. Even if you are not a programmer or a database designer or some other IS professional, you must take an active role in specifying the system's requirements and in managing the system's development project. You will also have an important role in testing the new system. Without active involvement on your part, it will only be good luck that causes the new system to meet your needs.

As a business professional, you are the person who understands business needs and requirements. If you want to apply social networking to your products, you are the one who knows how best to obtain customer responses. The technical people who build networks, the database designers who create the database, the IT people who configure the computers—none of these people know what is needed and whether the system you have is sufficient or whether it needs to be adapted to new requirements. You do!

In addition to management tasks, you will also have important roles to play in the *use* of information systems. Of course, you will need to learn how to employ the system to accomplish your job tasks. But you will also have important ancillary functions as well. For example, when using an information system, you will have responsibilities for protecting the security of the system and its data. You may also have tasks for backing up data. When the system fails (all do, at some point), you will have tasks to perform while the system is down as well as tasks to accomplish to help recover the system correctly and quickly.

Achieving Strategies

The last part of the definition of MIS is that information systems exist to help organizations *achieve their strategies*. First, realize that this statement hides an important fact: Organizations themselves do not "do" anything. An organization is not alive, and it cannot act. It is the people within a business who sell, buy, design, produce, finance, market, account, and manage. So, information systems exist to help people who work in an organization to achieve the strategies of that business.

Information systems are not created for the sheer joy of exploring technology. They are not created so the company can be "modern" or so the company can show it has a social networking presence on the Web. They are not created because the information systems department thinks they need to be created or because the company is "falling behind the technology curve."

This point may seem so obvious that you might wonder why we mention it. Every day, however, some business somewhere is developing an information system for the wrong reasons. Right now, somewhere in the world, a company is deciding to create a Facebook presence for the sole reason that "every other business has one." This company is not asking questions such as:

- "What is the purpose of our Facebook page?"
- "What is it going to do for us?"
- "What is our policy for employees' contributions?"
- "What should we do about critical customer reviews?"
- "Are the costs of maintaining the page sufficiently offset by the benefits?"

But that company should ask those questions! Chapter 2 addresses the relationship between information systems and strategy in more depth. Chapter 9 addresses social media and strategy specifically.

Again, MIS is the development and use of information systems that help businesses achieve their strategies. You should already be realizing that there is much more to this class than buying a computer, working with a spreadsheet, or creating a Web page.

1-5 What Is Information?

Based on our earlier discussions, we can now define an information system as an assembly of hardware, software, data, procedures, and people that interact to produce information. The only term left undefined in that definition is *information*, and we turn to it next.

Definitions Vary

Information is one of those fundamental terms that we use every day but that turn out to be surprisingly difficult to define. Defining *information* is like defining words such as *alive* and *truth.* We know what those words mean, we use them with each other without confusion, but they are nonetheless difficult to define.

In this text, we will avoid the technical issues of defining information and will use common, intuitive definitions instead. Probably the most common definition is that **information** is knowledge derived from data, whereas *data* is defined as recorded facts or figures. Thus, the facts that employee James Smith earns $70.00 per hour and that Mary Jones earns $50.00 per hour are *data*. The statement that the average hourly wage of all the graphic designers is $60.00 per hour is *information*. Average wage is knowledge derived from the data of individual wages.

Another common definition is that *information is data presented in a meaningful context*. The fact that Jeff Parks earns $30.00 per hour is data.[14] The statement that Jeff Parks earns half the average hourly wage of the graphic designers, however, is information. It is data presented in a meaningful context.

Another definition of information that you will hear is that *information is processed data* or, sometimes, *information is data processed by summing, ordering, averaging, grouping, comparing, or other similar operations.* The fundamental idea of this definition is that we do something to data to produce information.

There is yet a fourth definition of information, which was set out by the great research psychologist Gregory Bateson. He defined information as a *difference that makes a difference*.

For the purposes of this text, any of these definitions of information will do. Choose the definition that makes sense to you for the purpose you have at hand. The important point is that you discriminate between data and information. You also may find that different definitions work better in different situations.

Where Is Information?

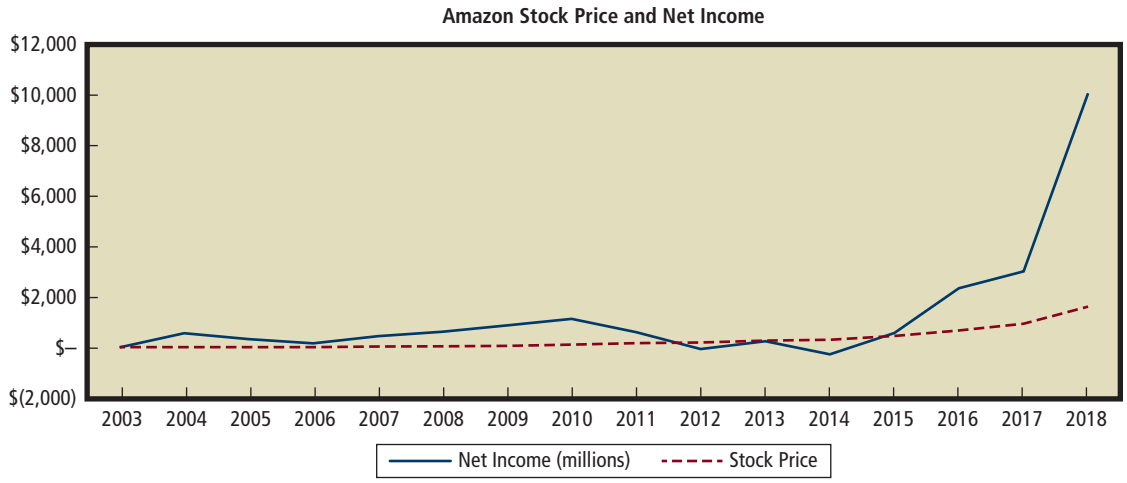
Suppose you create a graph of Amazon's stock price and net income over its history, like that shown in Figure 1-9. Does that graph contain information? Well, if it presents data in a meaningful context or if it shows a difference that makes a difference, then it fits two of the definitions of information, and it's tempting to say that the graph contains information.

However, show that graph to your family dog. Does your dog find information in that graph? Well, nothing about Amazon, anyway. The dog might learn what you had for lunch, but it won't obtain any information about Amazon's stock price over time.

Reflect on this experiment and you will realize that the graph is not, itself, information. The graph is data that you and other humans *perceive*, and from that perception you *conceive* information. In short, if it's on a piece of paper or on a digital screen, it's data. If it's in the mind of a human, it's information.

Why, you're asking yourself, do I care? Well, for one, it explains why you, as a human, are the most important part of any information system you use. The quality of your thinking, of your ability to conceive information from data, is determined by your cognitive skills. *The data is just the data; the information you conceive from it is the value you add to the information system*.

Figure 1-9 Amazon Stock Price and Net Income



SOURCE: © Based on data from www.nasdaq.com/symbol/amzn/historical

Furthermore, people have different perceptions and points of view. Not surprisingly, then, they will perceive different information from the same data. You cannot say to someone, "Look, it's right there in front of you, in the data" because it's not right there in the data. Rather, it's in your head, and your job is to explain what you have conceived so that others can understand it.

Finally, once you understand this, you'll understand that all kinds of common sentences make no sense. "I sent you that information" cannot be true. "I sent you the data, from which you conceived the information" is the most we can say. During your business career, this observation will save you untold frustration if you remember to apply it.

1-6 What Data Characteristics Are Necessary for Quality Information?

You have just learned that humans conceive information from data. As stated, the quality of the information that you can create depends, in part, on your thinking skills. It also depends, however, on the quality of the data you are given. Figure 1-10 summarizes critical data characteristics.

Accurate

First, good information is conceived from accurate, correct, and complete data that has been processed correctly as expected. Accuracy is crucial; business professionals must be able to rely on the results of their information systems. The IS function can develop a bad reputation in the organization if a system is known to produce inaccurate data. In such a case, the information system becomes a waste of time and money as users develop workarounds to avoid the inaccurate data.

A corollary to this discussion is that you, a future user of information systems, ought not to rely on data just because it appears in the context of a Web page, a well-formatted report, or a fancy query. It is sometimes hard to be skeptical of data delivered with beautiful, active graphics. Do not be misled. When you begin to use a new information system, be skeptical. Cross-check the data you are receiving. After weeks or months of using a system, you may relax. Begin, however, with skepticism. Again, you cannot conceive accurate information from inaccurate data.

Figure 1-10 Characteristics of Good Data

- Accurate
- Timely
- Relevant
  - To context
  - To subject
- Just barely sufficient
- Worth its cost

Timely

Good information requires that data be timely—available in time for its intended use. A monthly report that arrives 6 weeks late is most likely useless. The data arrives long after the decisions that required the information have been made. An information system that sends you a poor customer credit report after you have shipped the goods is unhelpful and frustrating. Notice that timeliness can be measured against a calendar (6 weeks late) or against events (before we ship).

When you participate in the development of an IS, timeliness will be part of the requirements you specify. You need to give appropriate and realistic timeliness needs. In some cases, developing systems that provide data in near real time is much more difficult and expensive than producing data a few hours later. If you can get by with data that is a few hours old, say so during the requirements specification phase.

Consider an example. Suppose you work in marketing and you need to be able to assess the effectiveness of new online ad programs. You want an information system that not only will deliver ads over the Web but that also will enable you to determine how frequently customers click on those ads. Determining click ratios in near real time will be very expensive; saving the data in a batch and processing it some hours later will be much easier and cheaper. If you can live with data that is a day or two old, the system will be easier and cheaper to implement.

Relevant

Data should be relevant both to the context and to the subject. Considering context, you, the CEO, need data that is summarized to an appropriate level for your job. A list of the hourly wage of every employee in the company is unlikely to be useful. More likely, you need average wage information by department or division. A list of all employee wages is irrelevant in your context.

Data should also be relevant to the subject at hand. If you want data about short-term interest rates for a possible line of credit, then a report that shows 15-year mortgage interest rates is irrelevant. Similarly, a report that buries the data you need in pages and pages of results is also irrelevant to your purposes.

Just Barely Sufficient

Data needs to be sufficient for the purpose for which it is generated, but just barely so. We are inundated with data; one of the critical decisions that each of us has to make each day is what data to ignore. The higher you rise into management, the more data you will be given and, because there is only so much time, the more data you will need to ignore. So, data should be sufficient, but just barely.

Worth Its Cost

Data is not free. There are costs for developing an information system, costs of operating and maintaining that system, and costs of your time and salary for reading and processing the data the system produces. For data to be worth its cost, an appropriate relationship must exist between the cost of data and its value.

Consider an example. What is the value of a daily report of the names of the occupants of a full graveyard? Zero, unless grave robbery is a problem for the cemetery. The report is not worth the time required to read it. It is easy to see the importance of economics for this silly example. It will be more difficult, however, when someone proposes new technology to you. You need to be ready to ask, "What's the value of the information that I can conceive from this data?" "What is the cost?" "Is there an appropriate relationship between value and cost?" Information systems should be subject to the same financial analyses to which other assets are subjected.

How does the **knowledge** in this chapter help **you**?

It's too late for Amanda, at least at eHermes. However, it's not too late for you, and it's not too late for Amanda at her next job. So, what are the takeaways from this chapter?

First, realize that the future belongs to businesspeople who can creatively envision new applications of information systems and technology. You don't have to be an IS major (though it is a very good major with excellent job prospects), but you should be able to innovate the use of MIS into the discipline in which you do major. How can management, marketing, accounting, production, and so on, take advantage of the benefits of Bell's Law, Moore's Law, and Metcalfe's Law?

Second, learn Reich's four key skills: abstract thinking, systems thinking, experimentation, and collaboration. And practice, practice, practice them. This class is the best one in the business school for teaching those skills, so engage in it. As you study and perform assignments, ask yourself how your activity relates to those four abilities and endeavor to improve your proficiency at them.

Next, learn the components of an IS and understand that every business professional needs to take an active role in new information systems development. Such systems are created for your needs and require your involvement. Know the difference between IT, IS, and MIS. Finally, learn the difference between information and data and what makes data valuable.

We're just getting started; there's lots more to come that can benefit Amanda (in her next job) and you!

Ethics Guide

Ethics and Professional Responsibility

Suppose you're a young marketing professional who has just taken a new promotional campaign to market. The executive committee asks you to present a summary of the sales effect of the campaign, and you produce the graph shown in Figure 1. As shown, your campaign was just in the nick of time; sales were starting to fall the moment your campaign kicked in. After that, sales boomed.

But note the vertical axis has no quantitative labels. If you add quantities, as shown in Figure 2, the performance is less impressive. It appears that the substantial growth amounts to less than 20 units. Still, the curve of the graph is impressive, and if no one does the arithmetic, your campaign will appear successful.

This impressive shape is only possible, however, because Figure 2 is not drawn to scale. If you draw it to scale, as shown in Figure 3, your campaign's success is, well, problematic, at least for you.

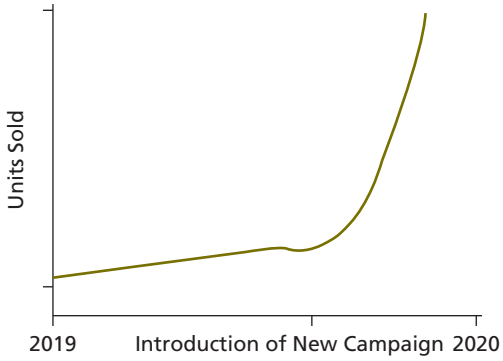


Figure 1

Which of these graphs do you present to the committee?

Each chapter of this text includes an Ethics Guide that explores ethical and responsible behavior in a variety of MIS-related contexts. In this chapter, we'll examine the ethics of data and information.

Centuries of philosophical thought have addressed the question "What is right behavior?" and we can't begin to discuss all of it here. You will learn much of it, however, in your business ethics class. For our purposes, we'll use two of the major pillars in the philosophy of ethics. We introduce the first one here and the second in Chapter 2.

The German philosopher Immanuel Kant defined the *categorical imperative* as the principle that *one should behave*

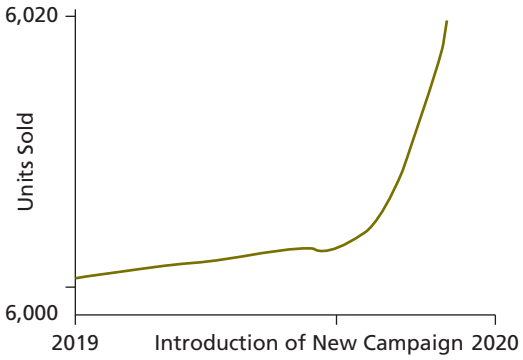


Figure 2

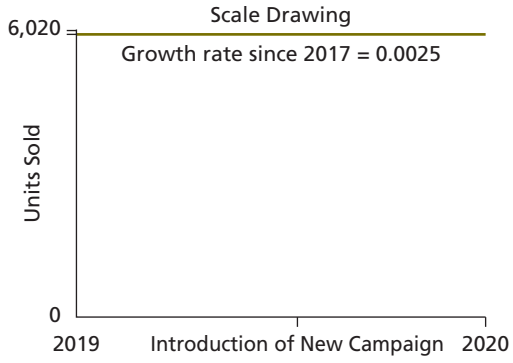


Figure 3

only in a way that one would want the behavior to be a universal law. Stealing is not such behavior because if everyone steals, nothing can be owned. Stealing cannot be a universal law. Similarly, lying cannot be consistent with the categorical imperative because if everyone lies, words are useless.

When you ask whether a behavior is consistent with this principle, a good litmus test is "Are you willing to publish your behavior to the world? Are you willing to put it on your Facebook page? Are you willing to say what you've done to all the players involved?" If not, your behavior is not ethical, at least not in the sense of Kant's categorical imperative.

Kant defined *duty* as the necessity to act in accordance with the categorical imperative. *Perfect duty* is behavior that must always be met. Not lying is a perfect duty. *Imperfect duty* is action that is praiseworthy but not required according to the categorical imperative. Giving to charity is an example of an imperfect duty.

Kant used the example of cultivating one's own talent as an imperfect duty, and we can use that example as a way of defining professional responsibility. Business professionals have an imperfect duty to obtain the skills necessary to accomplish their jobs. We also have an imperfect duty to continue to develop our business skills and abilities throughout our careers.

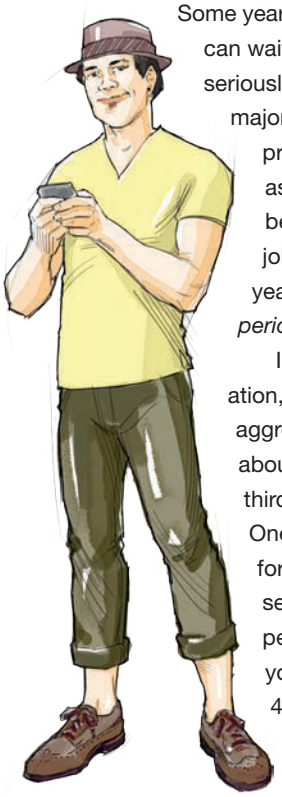
We will apply these principles in the chapters that follow. For now, use them to assess your beliefs about Figures 1 through 3 by answering the following questions.

Questions

1. Restate Kant's categorical imperative using your own words. Explain why cheating on exams is not consistent with the categorical imperative.
2. While there is some difference of opinion, most scholars believe that the Golden Rule ("Do unto others as you would have them do unto you.") is not equivalent to Kant's categorical imperative. Justify this belief.
3. Suppose you created Figure 1 using Microsoft Excel. To do so, you keyed the data into Excel and clicked the Make Graph button (there is one, though it's not called that). Voilà, Excel created Figure 1 without any labels and drawn out of scale as shown. Without further consideration, you put the result into your presentation.
   a. Is your behavior consistent with Kant's categorical imperative? Why or why not?
   b. If Excel automatically produces graphs like Figure 1, is Microsoft's behavior consistent with Kant's categorical imperative? Why or why not?
4. Change roles. Assume now you are a member of the executive committee. A junior marketing professional presents Figure 1 to the committee, and you object to the lack of labels and the scale. In response, the junior marketing professional says, "Sorry, I didn't know. I just put the data into Excel and copied the resulting graph." What conclusions do you, as an executive, make about the junior marketing professional in response to this statement?
5. Is the junior marketing person's response in question 4 a violation of a perfect duty? Of an imperfect duty? Of any duty? Explain your response.
6. If you were the junior marketing professional, which graph would you present to the committee?
7. According to Kant, lying is not consistent with the categorical imperative. Suppose you are invited to a seasonal barbecue at the department chair's house. You are served a steak that is tough, overcooked, and so barely edible that you secretly feed it to the department chair's dog (who appears to enjoy it). The chairperson asks you, "How is your steak?" and you respond, "Excellent, thank you."
   a. Is your behavior consistent with Kant's categorical imperative?
   b. The steak seemed to be excellent to the dog. Does that fact change your answer to part a?
   c. What conclusions do you draw from this example?

Career Guide

Five-Component Careers



Some years, even some decades, students can wait until their last semester to think seriously about jobs. They can pick a major, take the required classes, and prepare to graduate, all the while assuming that job recruiters will be on campus, loaded with good jobs, sometime during their senior year. *Alas, today is not one of those periods*.

In the current employment situation, you need to be proactive and aggressive in your job search. Think about it: You will be spending one-third of your waking life in your job. One of the best things you can do for yourself is to begin thinking seriously about your career prospects now. You don't want to find yourself working as a barista after 4 years of business school, unless, of course, you're planning on starting the next Starbucks.

So, start here. Are you interested in a career in MIS? At this point, you don't know enough to know, but Figures 1-6 and 1-7 should catch your attention. With job growth like that, in a category of jobs that is net of outsourcing, you should at least ponder whether there is a career for you in IS and related services.

But what does that mean? If you go to the U.S. Bureau of Labor Statistics, you can find that there are more than a million computer programmers in the United States today and more than 600,000 systems analysts. You probably have some notion of what a programmer does, but you don't yet know what a systems analyst is. Examine the five components in Figure 1-8, however, and you can glean some idea. Programmers work primarily with the software component, and system analysts work with the entire system, with all five components. So, as a systems analyst, you work with system users to determine what the organizational requirements are and then with technical people (and others) to help develop that system. You work as a cultural broker: translating the culture of technology into the culture of business, and the reverse.

Fortunately for you, many interesting jobs are not captured by the bureau's data. Why fortunate? Because you can use what you're learning in this course to identify and obtain jobs that other students may not think about or even know about. If so, you've gained a competitive advantage.

The figure on the next page provides a framework for thinking about careers in an unconventional way. As you can see, there are technical jobs in MIS; there are also fascinating, challenging, and high-paying nontechnical jobs. Consider, for example, professional sales. Suppose you have the job of selling enterprise-class software to the Mayo Clinic. You will sell to intelligent, highly motivated professionals with tens of millions of dollars to spend. Or suppose you are working for the Mayo Clinic on the receiving end of that sales pitch. How will you spend your tens of millions? You will need knowledge of your business, and you will need to understand enough technology to ask intelligent questions and interpret the responses.

Give this some thought by answering the discussion questions, even if they aren't assigned for a grade!

	Hardware	Software	Data	Procedures	People
Sales & Marketing	Vendors (IBM, Cisco, etc.)	Vendors (Microsoft, Oracle, etc.)	Vendors (Acxiom, Google, etc.)	Vendors (SAP, Infor, Oracle)	Recruiters (Robert Half, Lucas Group)
Support	Vendors Internal MIS	Vendors Internal MIS	Database administration Security	Vendors and internal customer support	Customer support Training
Development	Computer engineering Internal MIS	Application programmer Quality test engineer	Data modeler Database design	Business process management Process re-engineering	Training, Internal MIS recruiting
Management	Internal MIS	Internal MIS	Data administration	Project management	Technical management
Consulting	Project management, development, pre- and postsale support				

Questions

1. What does the phrase *in a category of jobs that is net of outsourcing* mean? Reread the discussion of Figure 1-6 if you're not certain. Why is this important to you?
2. Examine the five-component careers figure on this page and choose the row that seems most relevant to your interests and abilities. Describe a job in each component column of that row. If you are uncertain, Google the terms in the cells of that row.
3. For each job in your answer to question 2, describe what you think are the three most important skills and abilities for that job.
4. For each job in your answer to question 2, describe one innovative action that you can take this year to increase your employment prospects.

SOURCE: auremar/123RF

Active Review

Use the Active Review to verify that you understand the ideas and concepts that answer the Chapter Learning Objective Questions

1-1 Why Is Introduction to MIS the Most Important Class in the Business School?

Define *Bell's Law* and explain why its consequences are important to business professionals today. Describe how Moore's Law, Metcalfe's Law, Nielsen's Law, and Kryder's Law are changing how digital devices are used. State how business professionals should relate to emerging information technology.

1-2 How Will MIS Affect Me?

Define Reich's four key nonroutine cognitive skills. Give the text's definition of *job security* and use Reich's list to explain how this course will help you attain that security. Explain why systems thinking is important to businesses.

1-3 Why Are MIS-Related Jobs in High Demand?

Summarize IS-related job opportunities. According to the Bureau of Labor Statistics, how does the growth rate of IS-related jobs compare to the average growth rate of all jobs nationally? Describe why innovations in technology, or relative drops in the cost of technology, increase the value of IS-related job opportunities.

1-4 What Is MIS?

Identify the three important phrases in the definition of *MIS*. Explain why you can buy IT but you can never buy IS. What does that mean to you, as a potential future business manager? Name and define each of the five components of an information system. Using the five-component model, explain the difference between IT and IS. Explain why end users need to be involved in the management of information systems. Explain why it is a misconception to say that organizations do something.

1-5 What Is Information?

State four different definitions of information. Identify the one that is your favorite and explain why. State the difference between data and information. Explain why information can never be written on a piece of paper or shown on a display device.

1-6 What Data Characteristics Are Necessary for Quality Information?

Create a mnemonic device for remembering the characteristics of good data. Explain how these data characteristics relate to information quality.

How does the **knowledge** in this chapter help **you**?

Summarize how mastery of Reich's four skills will serve you in your career. Explain why every business professional needs to learn the basics of IS.

Key Terms and Concepts

Abstract reasoning, 10
Bell's Law, 5
Collaboration, 10
Computer hardware, 15
Computer-based information system, 15
Data, 15
Digital Revolution, 5
Experimentation, 11
Five-component framework, 15
Information, 17
Information Age, 5
Information system (IS), 13
Information technology (IT), 13
Kryder's Law, 7
Management information systems (MIS), 13
Metcalfe's Law, 7
Moore's Law, 6
Nielsen's Law, 7
People, 15
Procedures, 15
Software, 15
System, 15
Systems thinking, 10
Technology skills gap, 11

End of Chapter Questions

1-1. MyLabMIS Do you agree that this course is the most important course in the business school? Isn't accounting more important? No business can exist without accounting. Or isn't management more important? After all, if you can manage people, why do you need to know how to innovate with technology? You can hire others to think innovatively for you.

On the other hand, what single factor will affect all business more than IS? And aren't knowledge of and proficiency with IS and IT key to future employment and success?

Give serious thought to this question and write a single-page argument as to why you agree or disagree.

1-2. MyLabMIS Consider the four definitions of information presented in this chapter. The problem with the first definition, "knowledge derived from data," is that it merely substitutes one word we don't know the meaning of (information) for a second word we don't know the meaning of (knowledge). The problem with the second definition, "data presented in a meaningful context," is that it is too subjective. Whose context? What makes a context meaningful? The third definition, "data processed by summing, ordering, averaging, etc.," is too mechanical. It tells us what to do, but it doesn't tell us what information is. The fourth definition, "a difference that makes a difference," is vague and unhelpful.

Also, none of these definitions helps us to quantify the amount of information we receive. What is the information content of the statement that every human being has a navel? Zero—you already know that. In contrast, the statement that someone has just deposited $50,000 into your checking account is chock-full of information. So, good information has an element of surprise.

Considering all of these points, answer the following questions:

a. What is information made of?

b. If you have more information, do you weigh more? Why or why not?

c. When you give a copy of your transcript to a prospective employer, how is information produced? What part of that information production process do you control? What, if anything, can you do to improve the quality of information that the employer conceives?

d. Give your own best definition of information.

e. Explain how you think it is possible that we have an industry called *information technology* but we have great difficulty defining the word *information*.

1-3. MyLabMIS Consider costs of a system in light of the five components: costs to buy and maintain the hardware; costs to develop or acquire licenses to the software programs and costs to maintain them; costs to design databases and fill them with data; costs of developing procedures and keeping them current; and, finally, human costs to both develop and use the system.

a. Over the lifetime of a system, many experts believe that the single most expensive component is people. Does this belief seem logical to you? Explain why you agree or disagree.

b. Consider a poorly developed system that does not meet its defined requirements. The needs of the business do not go away, but they do not conform themselves to the characteristics of the poorly built system. Therefore, something must give. Which component picks up the slack when the hardware and software