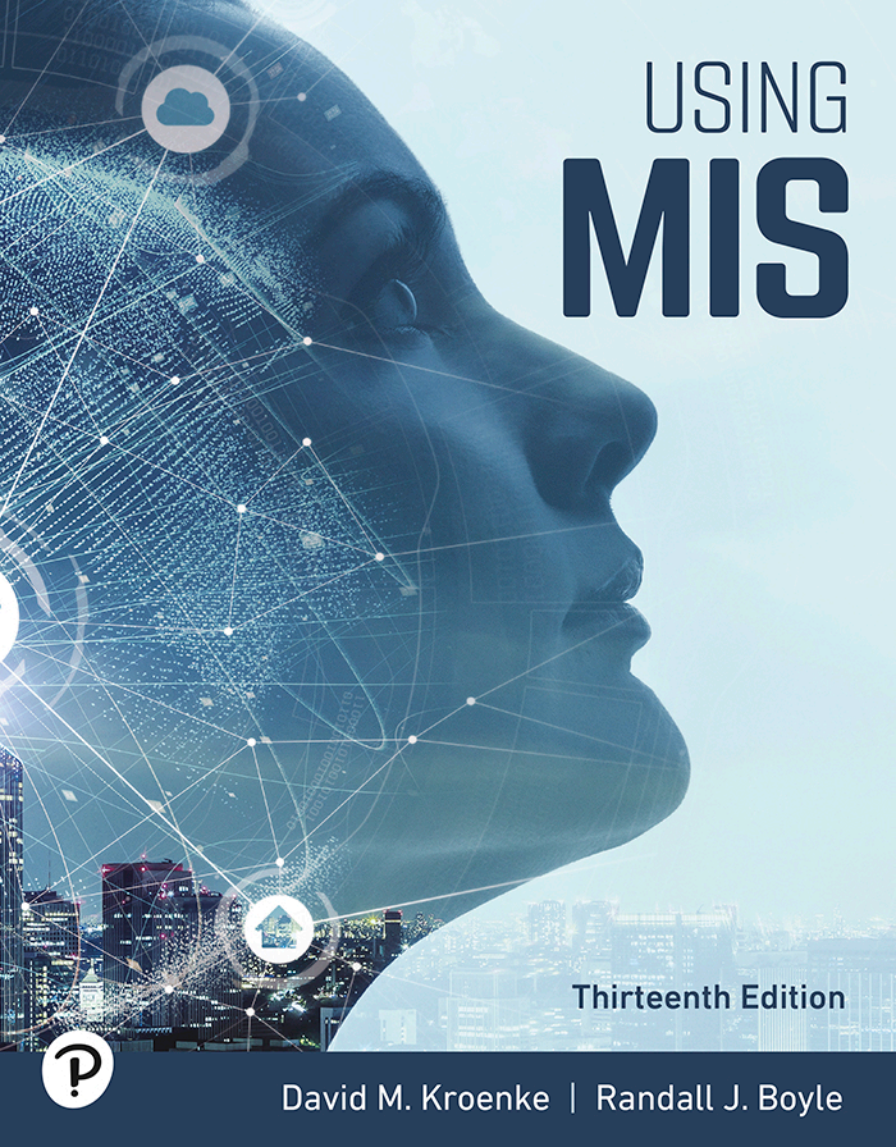




USING **MIS**

Thirteenth Edition



David M. Kroenke | Randall J. Boyle

Using **MIS**

Using MIS—Letter to Student

Dear Student,

Honestly, this is a fun class. You're going to learn about the things you've been hearing about in the news, like artificial intelligence, machine learning, cybersecurity, virtual reality, analytics, self-driving cars, 3D printing, and social media.

This isn't a highly technical programming class. It's a class about *value*. More specifically, it's about how to generate value using technology. It's common for students to learn about *either* business *or* technology, but learning both is difficult. All modern high-paying jobs require the combination of both business knowledge and technical skills. This class will introduce you to the major areas of management information systems and help you start building your technical skills.

You'll also learn how to use technology to create innovative products and services, reduce costs, increase revenue, and improve working conditions. Apple (\$3.0 trillion), Microsoft (\$2.5 trillion), Google (\$1.5 trillion), Amazon (\$1.4 trillion), Tesla (\$895 billion), and Facebook (\$757 billion) have done this to become the most valuable companies ever. People who work for these companies do innovative and interesting work, and they're well paid too.

In fact, after you graduate, the highest-paying jobs will likely be tech jobs. Companies are becoming more and more dependent on technology. New technology is driving the demand for skills that weren't in demand 20 years ago. Cloud architect, DevOps engineer, data scientist, intelligence analyst, AI engineer, robotics engineer, and computer vision engineer either didn't exist or weren't hot jobs 20 years ago. Now these are the jobs around. Twenty years from today, the highest-paying jobs will be new jobs that currently don't exist.

For example, ChatGPT was released in November 2022 and grew to 100 million users in just two months. This makes it the fastest-growing technology ever. Companies responded to this and are now devoting enormous resources toward using artificial intelligence.

According to a 2023 survey by PricewaterhouseCoopers, 36 percent of U.S. CEOs plan to deploy AI company-wide, and an additional 35 percent have already implemented AI in multiple areas within their organizations.¹ Companies are looking to AI-power their smart devices, robots, drones, agricultural systems, military platforms, and medical systems.

All of these companies will need workers who understand AI, can use AI effectively, and can develop new AI applications. Mundane, repetitive, lower-paying, routine jobs will disappear, but new highly paid jobs will be created to manage these new technologies. The number of workers won't decrease, but the skills demanded by employers will.

If you're willing to continuously learn, be creative, develop nonroutine problem-solving skills, and look for new opportunities to apply emerging technology to facilitate your organization's strategy, you'll never want for work. This is true whether your job is in marketing, operations, sales, accounting, finance, entrepreneurship, or another discipline.

The trick to turning information systems to your advantage is being able to predict technological innovations and then get ahead of them. You can use the knowledge from this course to help you obtain and thrive in an interesting and rewarding career in business.

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

Randy Boyle & David Kroenke

The Guides

Each chapter includes five unique *guides* that focus on current issues in information systems. In each chapter, one of the guides focuses on the impact of *innovative* technology, and the second focuses on information *security* issues in business. The third guide focuses on information systems *careers*, the fourth focuses on an *ethical* issue in the field of information systems, and the fifth focuses on *using AI* to solve problems discussed in the chapter. 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.

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Learning AIDS for Students

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And new to this edition, you can experience the Pearson AI Study Tool, which gives you individualized help with instant explanations, on-demand summaries, and choose-your-own practice.

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 structure that provides features and various learning aids to help you succeed in this course.

Chapter Features and Learning Aids

Resource	Description	Benefit	Example
MIS Headlines (etext only)	Current news articles and discussion questions open each chapter and are updated monthly.	Makes content relevant to what is happening in the world today.	Varies from month to month and articles are archived.
Chapter Introduction Business Example	Each chapter begins with a description of a business situation that motivates the need for the chapter's contents. We focus on two different businesses over the course of the text: Banterby, an AI-driven bot services company; and iMed Analytics, a healthcare analytics startup opportunity.	Understand the relevance of the chapter's content by applying it to a business situation.	Chapter 9, opening vignette: Social Media Information Systems and iMed Analytics
Chapter Preview and Query-Based Approach	Each chapter starts with a list of questions, and each major heading is a question. The Active Review contains tasks for you to perform in order to demonstrate your ability to answer the questions.	Use the questions to manage your time, guide your study, and review for exams.	Chapter 1, Q1-4: How Can You Use the Five-Component Model? Chapter 6, Q6-4: How Does the Internet Work?
What to expect in 2034?	Each chapter concludes with a discussion of how the concepts, technology, and systems described in that chapter might change by 2034.	Learn to anticipate changes in technology and recognize how those changes may affect the future business environment.	Chapter 8, 2034? discusses the future of ERP applications
Case Study	Each chapter includes a case study at the end.	Apply newly acquired knowledge to real-world situations.	Case Study 6, Salesforce.com

Resource	Description	Benefit	Example
Guides	Each chapter includes four guides that focus on current issues in information systems. One addresses new <i>innovations</i> , one addresses <i>ethics</i> , one addresses <i>security</i> , one addresses information systems <i>careers</i> , and one addresses <i>using AI</i> .	Stimulate thought and discussion. Understand how new innovations in the chapter apply to everyday situations. Address ethics and security once per chapter. Learn about real-world IS jobs.	Chapter 5, Ethics Guide: Searching for Clues and Your Face Chapter 8, Security Guide: REvil Ransomware Chapter 9, Career Guide: Social Media/Online Reputation Manager Chapter 2, So What? The Drones Are Coming Chapter 3, Using an AI
Ask an AI	Each chapter includes a section of AI application activities.	Engages students with “using” AI to perform real-world tasks to gain the skills they will need.	Chapter 1, Ask an AI
Active Review & Key Terms	This review provides a set of activities for you to perform in order to demonstrate your ability to answer the primary questions addressed by the chapter.	After reading the chapter, use the Active Review to check your comprehension. Use for class and exam preparation.	Chapter 9, Active Review
Using Your Knowledge	These exercises ask you to take your new knowledge one step further by applying it to a practice problem.	Test your critical-thinking skills.	Chapter 4, Using Your Knowledge
Collaboration Exercises	These exercises and cases ask you to collaborate with a group of fellow students, using collaboration tools introduced in Chapter 1.	Practice working with colleagues toward a stated goal.	Collaboration Exercise 2 discusses how to tailor a high-end resort’s information system to fit its competitive strategy
Application Exercises	These exercises ask you to solve situations using spreadsheet (Excel), database (Access), or Web applications.	Develop your computer skills.	AE10-2 builds on your knowledge from Chapter 10 by asking you to install and use a Tor Web browser.
International Dimension	This module at the end of the text discusses international aspects of MIS. It includes the importance of international IS, the localization of system components, the roles of functional and cross-functional systems, international applications, supply chain management, and challenges of international systems development.	Understand the international implications and applications of the chapters’ content.	International Dimension QID-3, How Do Inter-enterprise IS Facilitate Global Supply Chain Management?

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Thirteenth Edition

Using MIS

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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. Artificial intelligence made huge strides over the past year. OpenAI released ChatGPT and amazed the public. Corporations made AI's a key part of their strategic plan and started allocating funds for these key changes. These AIs will soon be running organizations, directing robots, and driving cars.

Waymo (Google), Cruise, and Mobileye logged tens of millions of autonomous miles, and multiple robotaxi services are operational. Automobile manufacturers are developing their own autonomous vehicles or partnering with industry leaders. A recent report by McKinsey & Company indicates that self-driving vehicles could reach significant adoption as early as 2035,² but KPMG estimates that widespread adoption won't happen until 2050.³

At the annual Consumer Electronics Show (CES) in 2023, a unified IoT smart device standard named Matter was a huge hit. It allows smart devices from a variety of manufacturers to talk with each other. It is revolutionizing smart devices and encouraging their adoption.

BMW showed off their new concept car named the BMW i Vision Dee (Digital Emotional Experience) that was a talking electric vehicle (EV). The AI virtual assistant can anticipate passengers' questions, display information about their journey on the windshield, and remember driving habits. Even more interesting, it is covered with 240 different E ink color panels that allow you to change the color of your car.

Digital reality has really taken off. Microsoft (HoloLens 2) and Magic Leap (Magic Leap 2) released their second-generation mixed-reality devices in 2019 and 2022, respectively. As of publication of this text, Microsoft does not have an official release date for HoloLens 3. Apple (Vision Pro) and TCL Electronics (RayNeo X2) released their first-generation devices in 2023. Microsoft has had success focusing on shipping devices to enterprise partners. Magic Leap, on the other hand, was focusing on the consumer market and had to let 600 employees go in 2020. It's estimated that the digital reality market will be \$165 billion by 2030.⁴ 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. Companies have begun to focus on process automation and the use of robotics.

In 2023, the automotive industry set a record with over 1 million robots working in factories around the world. The automotive industry accounts for about 30 percent of all industrial robots. In the United States, Amazon is using 520,000 robots to help fulfill customer orders. Amazon's robots can autonomously find, scan, move, pick, and store items.⁵

Amazon, FedEx, UPS, Boeing, and DHL are all testing drones for package delivery. The drone package delivery market is estimated to be worth \$91 billion by 2030. The drone package delivery market is estimated to be worth \$9 billion by 2027.⁶ Amazon anticipated starting drone deliveries in late 2019, but we are just now starting to see drone deliveries being offered to consumers. McKinsey & Co. estimates that over 875,000 drone deliveries were made between 2021 and 2022. They predict that over 1 million deliveries were made in 2023.⁷

Drone delivery is expected to reduce Amazon's shipping costs by 50 percent.⁸ Amazon would use less fuel, buy fewer delivery vehicles, and hire fewer drivers. 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.

Large-scale data breaches continue to be a major problem. For example, in 2016, Yahoo! Inc. disclosed the loss of 3 billion customer records in 2013.⁹ In 2020, mega breaches were reported by Keepnet Labs (5 billion), CAM4 (10 billion), Advanced Info (8 billion), and

Le Group Figaro (7.4 billion). But 2021 was a relatively quiet year with only one large data breach by FSB Markets Inc. (16 billion).¹⁰ Activity picked up again in 2022 with the loss of 20 billion records in 4,146 security incidents.¹¹ And these mega breaches don't even include the loss of 487 million records from WhatsApp (2022), 235 million records from Twitter (2023), or the loss of more than 560 million records from Ticketmaster (2024).¹² More than half of the user records stolen (77 percent) were taken by external hackers targeting businesses.

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.

Why This Thirteenth 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 traditional textbook revision cycles. The content is often researched and written several months before publication.

For some areas of study, this amount of time may not matter very much. 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-2023) valued at \$754B. That's a whopping \$39B in growth per year for 19 years! MIS changes fast—very fast. We hope this new edition is the most up-to-date MIS textbook available. We will be working to deliver more frequent updates to this edition, so that major industry changes and developments are covered quickly.

What's New?

There are significant changes and updates in this new edition, particularly around AI, Business Analytics, and overall currency. There were large changes made to Chapter 10. Moderate changes were made to Chapters 9, 6, and 3.

- NEW coverage of Artificial general intelligence (AGI) (ch 3), generative AI (throughout)
- NEW coverage of Business Analytics (ch 3) and Data Science (ch 5)
- NEW MIS Headlines articles in each chapter of the eText provide monthly news and industry happens to keep you and your students current
- NEW 25 end of chapter application projects focused on Analytics that use both Excel and Access.
- NEW “Ask an AI” guides to provide applied AI projects and content
- NEW and expanded coverage of cybersecurity
- NEW chapter opening scenario for Chapters 1–6 focused on an AI-powered chatbot start up named Banterby. We created the photos for the chapter opening scenarios with Shutterstock AI generation.

New sections in Chapter 10 include coverage of the cybersecurity threat environment, sources of threats, phishing, Crime-as-a-Service, cybersecurity tradeoffs, the C.I.A. security goals, the NIST cybersecurity framework, cybersecurity best practices, passphrases, web trackers, access controls, encryption and decryption, network security, host hardening, centralized deployment, patch management, vulnerability testing, SQL injection, data breaches, data breach motives, attack vectors, Target Corp. data breach, incident response, and NIDS and DLP systems.

New sections in Chapters 9, 6, and 3 include content creators, social media earnings, social media marketing, LAN standards, wireless standards, fiber standards, wireless WANs, database education and certification, cryptocurrencies, Android, BI, Business Analytics, Data Science, artificial general intelligence (AGI), generative AIs (ChatGPT and Gemini), and critical thinking and creativity.

Chapters 1 through 6 begin with a new discussion of Banterby, a startup that provides AI-powered chatbot services. Chapters 7 through 12 continue to be introduced by the discussion of iMed Analytics, a cloud-based medical analytics 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, and utilitarianism is introduced in the Ethics Guide in Chapter 2.

As shown in Table 1, additional changes were made to every chapter, including 12 new Ask an AI guides, 8 new So What? features, 7 new Security Guides, 5 new Career Guides, 5 new Ethics Guides, and 3 new chapter cases, and 4 updated chapter cases. The new Ask an AI guides were included due to numerous requests for more applied AI content showing students how to use AI's like ChatGPT and Google's Gemini.

Additional figures, like the one showing the encryption and decryption process in Chapter 10, were added to make the text more accessible. 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.

Table 1: Changes in the Thirteenth Edition

Chapter	Change
1	New Banterby AI introductory vignette
	New Ask an AI Guide
	New and updated charts for CPU and data storage growth
	Expanded discussion in Q1-2 of critical skills to include <i>critical thinking and creativity</i>
	New job sector comparison statistics
	Updated BLS job statistics for Business and MIS occupations
	Updated Q1-7 2034 discussion about AI and automation
	Updated So What? Guide (IoTrends)
	Updated Case Study 1 (Pluralsight)
2	New Banterby AI introductory vignette
	New So What? Guide (The Drones Are Coming)
	New Security Guide (Cyber War, before Kinetic War)
	New Career Guide (Sr. Director Physician Services & Integrated Applications)
	New Ethics Guide (Targeted Triangulation Without Consent)
	New Ask an AI Guide
	Updated Case Study (Amazon)
	Updated Q2-2 discussion of Banterby strategy
3	New Banterby AI introductory vignette
	New So What? Guide (Bossware)
	New Ethics Guide (Bot Inflation)
	New Ask an AI Guide
	New Case Study (OpenAI)
	New section on BI vs Business Analytics, Data Science
	Updated Microsoft Office 2021 images

(Continued)

Table 1 (Continued)

Chapter	Change
	Updated images, charts, and statistics throughout the chapter
	Added artificial general intelligence (AGI) discussion
	Updated examples using ChatGPT and Google Lens
	New section comparing of generative AIs (Gemini, ChatGPT, and BlenderBot)
	Updated Collaboration Exercise 3
4	New Banterby AI introductory vignette
	New So What? Guide (New from CES 2023)
	New Career Guide (President Basebuild Inc.)
	New Ask an AI Guide
	New Case Study (Coinbase)
	Updated AR, MR, and VR content, Apple Vision Pro
	Updated autonomous vehicles (Tesla) and drone examples (Walmart)
	New Q4-2 charts and discussion of cryptocurrencies
	New Q4-3 charts and discussion of Android, desktop, tablet, and smartphone market share
	Updated industry statistics throughout the chapter
5	New Banterby AI introductory vignette
	New Security Guide (Planes Down, Planes Down)
	New Ask an AI Guide
	New section Q5-7 Database Education and Certifications
	Updated images and statistics throughout the chapter
	Updated Excel and Access 2021 images
	Updated Q5-8 2034
	New Collaboration Exercise 5 (AI & Data)
	Updated Case Study 5 (Datadog)
6	New Banterby AI introductory vignette
	New Ethics Guide (Splinternet)
	New Ask an AI Guide
	More examples of IaaS (Rackspace, Google Compute Engine) and SaaS (Dropbox)
	Q6-3 updated discussion of LAN standards, speeds, cabling, and costs
	Q6-3 updated discussion of Wireless standards, speeds, distances, and costs
	Q6-3 new discussion of fiber-optic communication, optical fiber, cladding, electromagnetic interference, and the benefits of fiber over wired or wireless communication
	Q6-3 updated discussion of wireless WAN speeds and providers
	Q6-6 updated discussion of Banterby Cloud services
	Q6-8 updated 2034 discussion (Starlink, 5G, Cloud startups, Crime-as-a-Service, and telemedicine)
	Updated Security Guide (Insider Threats)
	Updated cloud usage and market share statistics
	Updated industry statistics, web screenshots throughout the chapter
7	New Security Guide (ChatGPT as a Security Tool)
	New Ask an AI Guide

Chapter	Change
	Added references to NeoOffice for MacOS, Slido, Git, Azure DevOps, Slack, Trello, Asana, Basecamp, and Yammer
	Updated SharePoint and Google Drive images
	Removed references to Google+
	Updated chapter statistics and images
	Updated Q7-9 2034 (AI coworkers)
	Updated So What guide
8	New So What? Guide (Designed Deficiencies)
	New Security Guide (REvil Ransomware)
	New Career Guide (Senior Data Engineer)
	New Ask an AI Guide
	Updated discussion on Q8-5 ERP vendors, market share, and Microsoft Dynamics 365
	Updated Q8-8 2034
	Updated Case Study on Uber, statistics, discussion, and chart of monthly users
	Updated chapter statistics and images
9	New So What? Guide (Social Credit Systems)
	New Security Guide (TikTok Espionage)
	New Ask an AI Guide
	Updated SM data for TikTok and WhatsApp; removed Google+
	New Q9-1 section on Content Creators
	New Q9-3 discussion on earnings through sponsored social media, views, and followers
	Updated Q9-7 updated discussion about the social media policy from Intel
	New Q9-8 2034, trends in Social Media Marketing: short-form video, long-form video, creator economy, influencer, memes, and podcasts; shifting social media, and integration of social media
	Updated Collaboration Exercise 9 Twitter profits, purchase, and updated comparison data
	Updated industry statistics and charts throughout the chapter
10	New So What? Guide (New from Black Hat)
	New Security Guide (Vishing)
	New Career Guide (Manager of Security Operations)
	New Ethics Guide (Selling Vulnerabilities)
	New Case Study (Colonial Pipeline Attack)
	New Ask an AI Guide
	New Q10-1 section on Cybersecurity Threats
	New Q10-1 discussion on sources of threats; employees, insider threats, hackers, APTs, hostile governments, and natural disasters
	New Q10-1 Phishing example
	New Q10-1 discussion on Crime-as-a-Service including Ransomware-as-a-Service, Scanning-as-a-Service, Spamming-as-a-Service, Malware Distribution-as-a-Service, Phishing-as-a-Service, and Access-as-a-Service
	New Q10-2 discussion about cybersecurity tradeoffs
	Included discussion about security policies and risk management
	New Q10-2 discussion about confidentiality, integrity, and availability (CIA)

(Continued)

Table 1 (Continued)

Chapter Change	
	New Q10-2 discussion on the NIST Cybersecurity framework
	New Q10-3 discussion about best practices related to data backup, installing updates, encrypting data, controlling access to devices, and using trusted apps
	New Q10-3 discussion about passphrases and password cracking
	New Q10-3 discussion about web trackers, web beacons, browser and fingerprinting
	New Q10-4 discussion about access controls, AAA framework, verifier, supplicant, logging, two-factor and multi-factor authentication, costs of authentication methods
	New graphics and explanation of the encryption and decryption process, ciphers, plaintext, and ciphertext
	Updated references to TLS to reflect the depreciation of SSL
	New Q10-4 discussion about Network Security, man-in-the-middle attacks, evil twin access points, wireless signal jammers
	New Q10-5 discussion of host hardening, centralized deployment, disk images, and inheritance
	New Q10-5 discussion of centralized patch management and update services
	New Q10-5 discussion of vulnerability testing, penetration testers, testing software, and leakware
	New Q10-5 SQL injection discussion and example (login bypass)
	Expanded Q10-5 discussion on data security policies and suggestions
	New Q10-6 discussion of user account management and inheritance of permissions
	New Q10-7 section on data breaches including charts on the largest data breaches, data breach costs
	New Q10-7 discussion on data breach motives including PII, carding, extortion
	New Q10-7 discussion about attack vectors, exploits, spear phishing
	New Q10-7 discussion about the anatomy of the Target Corp. data breach
	New Q10-8 discussion on incident response expanded to include walkthroughs, business continuity planning, and CSIRTs
	New Q10-8 discussion on data breach best practices, legal and financial consequences, PCI DSS standards, and FERPA
	New Q10-8 discussion on how to avoid data breaches including NIDS and DLP systems
	New industry statistics and charts throughout the chapter
11	New So What? Guide (Shadow IT)
	New Security Guide (Cybersecurity Trends)
	New Career Guide (Chief Technology Officer)
	New Ethics Guide (AI Outsourced)
	New Ask an AI Guide
	Updated industry statistics and charts throughout the chapter
	Updated Q11-5 2034 discussion
12	New So What? Guide (Universal Hyper-Automation)
	New Ask an AI Guide
	Updated Q12-7 2034, Google robotics and systems redevelopment

Chapter	Change
	Updated Microsoft Project Professional 2019 images
	New charts and statistics about Agile and Scrum use
International Dimension	Updated statistics about International Internet access (users, fixed, and mobile), and native and second languages
	New QID-4 discussion of blocked social media platforms by country
Application Exercises	New exercise AE3-3 Using ChatGPT
	New exercise AE3-4 Gemini vs ChatGPT
	Updated exercise AE3-5 AI Chat Bot (Mitsuku) Turing Test questions
	Updated exercise AE6-1 Google Speedtest
	New exercise AE10-4 HashCalc
	New exercise AE10-5 Threat Maps
	Updated data files
	Updated Microsoft Office 2021 compliant files and chapter images

How to Use this Textbook

Each chapter is set up with a content flow to engage students in learning. Chapters open with an *MIS Headline* article (eText only) to link the chapter content to relevant, current events in technology. The chapter business scenario sets the stage for the topics covered and the preview and learning objectives define the details of what will be covered. The chapter flows with the question-based approach that keeps students engaged and the *Check Your Understanding* questions following the sections help students make sure they understood the content. The chapter objectives conclude with the “What to Expect in 2034” that explores future developments to watch for.

The next sections include important content you will want to assign including:

- Chapter Case Study
- Topical Guides, covering Security, Careers, Ethics, and the new Ask an AI guide
- End of chapter review and application sections

For an interactive and experiential learning approach, use the MyLab MIS for Using MIS 13e.

The following table details each section of the chapter.

Resource	Description	Benefit	Example
MIS Headlines (etext only)	Current news articles and discussion questions open each chapter and are updated monthly.	Makes content relevant to what is happening in the world today.	Varies from month to month and articles are archived.
Chapter Introduction Business Example	Each chapter begins with a description of a business situation that motivates the need for the chapter’s contents. We focus on two different businesses over the course of the text: Banterby, an AI-driven bot services company; and iMed Analytics, a healthcare analytics startup opportunity.	Understand the relevance of the chapter’s content by applying it to a business situation.	Chapter 9, opening vignette: Social Media Information Systems and iMed Analytics

Resource	Description	Benefit	Example
Chapter Preview and Query-Based Approach	Each chapter starts with a list of questions, and each major heading is a question. The Active Review contains tasks for you to perform in order to demonstrate your ability to answer the questions.	Use the questions to manage your time, guide your study, and review for exams.	Chapter 1, Q1-4: How Can You Use the Five-Component Model? Chapter 6, Q6-4: How Does the Internet Work?
What to expect in 2034?	Each chapter concludes with a discussion of how the concepts, technology, and systems described in that chapter might change by 2034.	Learn to anticipate changes in technology and recognize how those changes may affect the future business environment.	Chapter 8, 2034? discusses the future of ERP applications
Case Study	Each chapter includes a case study at the end.	Apply newly acquired knowledge to real-world situations.	Case Study 6, Salesforce.com
Guides	Each chapter includes four guides that focus on current issues in information systems. One addresses new <i>innovations</i> , one addresses <i>ethics</i> , one addresses <i>security</i> , one addresses information systems <i>careers</i> , and one addresses <i>using AI</i> .	Stimulate thought and discussion. Understand how new innovations in the chapter apply to everyday situations. Address ethics and security once per chapter. Learn about real-world IS jobs.	Chapter 5, Ethics Guide: Searching for Clues and Your Face Chapter 8, Security Guide: REvil Ransomware Chapter 9, Career Guide: Social Media/Online Reputation Manager Chapter 2, So What? The Drones Are Coming Chapter 3, Using an AI
Ask an AI	Each chapter includes a section of AI application activities.	Engages students with “using” AI to perform real-world tasks to gain the skills they will need.	Chapter 1, Ask an AI
Active Review & Key Terms	This review provides a set of activities for you to perform in order to demonstrate your ability to answer the primary questions addressed by the chapter.	After reading the chapter, use the Active Review to check your comprehension. Use for class and exam preparation.	Chapter 9, Active Review
Using Your Knowledge	These exercises ask you to take your new knowledge one step further by applying it to a practice problem.	Test your critical-thinking skills.	Chapter 4, Using Your Knowledge
Collaboration Exercises	These exercises and cases ask you to collaborate with a group of fellow students, using collaboration tools introduced in Chapter 1.	Practice working with colleagues toward a stated goal.	Collaboration Exercise 2 discusses how to tailor a high-end resort’s information system to fit its competitive strategy
Application Exercises	These exercises ask you to solve situations using spreadsheet (Excel), database (Access), or Web applications.	Develop your computer skills.	AE10-2 builds on your knowledge from Chapter 10 by asking you to install and use a Tor Web browser.

Resource	Description	Benefit	Example
International Dimension	This module at the end of the text discusses international aspects of MIS. It includes the importance of international IS, the localization of system components, the roles of functional and cross-functional systems, international applications, supply chain management, and challenges of international systems development.	Understand the international implications and applications of the chapters' content.	International Dimension QID-3, How Do Inter-enterprise IS Facilitate Global Supply Chain Management?

Importance of MIS

As stated, we continue to believe that we are teaching the single most important course in the business school. The rationale for this bold statement is presented in Chapter 1, starting on page 1. In brief, the argument relies on two observations.

First, processing power, interconnectivity of devices, storage capacity, and bandwidth are all increasing so rapidly that it's fundamentally changing how we use digital devices. Businesses are increasingly finding—and, more importantly, increasingly *required* to find—innovative applications for information systems. The use of AI to manage customer relationship systems, personalize social media feeds, filter spam, and use smart devices is just a few examples. But this is only the tip of the iceberg. For at least the next 10 years, every business professional will, at the minimum, need to be able to assess the efficacy of proposed IS applications. To excel, business professionals will also need to define innovative IS applications.

Further, professionals who want to emerge from the middle ranks of management will, at some point, need to demonstrate the ability to manage projects that develop these innovative information systems. Such skills will not be optional. Businesses that fail to create systems that take advantage of changes in technology will fall prey to competition that can create such systems. So too, will business professionals.

The second premise for the singular importance of the MIS class relies on the essential skills for knowledge workers in the 21st century. These include *abstract reasoning*, *critical thinking*, *systems thinking*, *creativity*, the ability to *experiment*, and the ability to *collaborate*.

For reasons set out in Chapter 1, we believe the MIS course is the single best course in the business curriculum for learning these four key skills.

Today's Role for Professors

What is our role as MIS professors? Students don't need us for definitions; they have the Web for that. They don't need us for detailed notes; they have the PowerPoints. Consequently, when we attempt to give long and detailed lectures, student attendance can fall. And this situation can be more dramatic for online courses.

We need to construct useful and interesting experiences for students to apply MIS knowledge to their goals and objectives. In this mode, we are more like track coaches than the chemistry professor of the past. And our classrooms are more like practice fields than lecture halls.¹²

Of course, the degree to which each of us moves to this new mode depends on our goals, our students, and our individual teaching styles. Nothing in the structure or content of this edition assumes that a particular topic will be presented in a nontraditional manner. But every chapter contains materials suitable for use with a coaching approach, if desired.

And for those using the MyLab, there are a variety of experiential learning activities including video exercises, decision simulations, and Forage Job simulations.

In addition to the chapter feature titled "So What?" all chapters include a collaboration exercise that students can use for team projects inside and outside of class. As with earlier editions, each chapter contains guides that describe the practical implications of the chapter

contents that can be used for small in-class exercises. Additionally, every chapter concludes with a case study that can be the basis for student activities. Finally, this edition contains 49 application exercises using productivity tools to solve real-world problems. The MyLab also comes with the option to include a full Pearson Office series suite that provides instruction, live-in the application, auto-graded projects, and training simulations. This is a great option to train students on the essential skills in Excel, Access, Word, or PPT that students will need for academic and professional success.

Banterby and iMed Analytics Cases

Each part and each chapter open with a fictitious scenario intended to get students involved emotionally, if possible. 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 Banterby case and continues the iMed Analytics case from the twelfth edition.

For this edition, we have replaced the illustrations for the scenarios with AI generated photos. There is lots to learn from these photos in terms of the current state of AI. Photos are challenging and repeating people in photos is not possible. This will likely change even by the time the textbook publishes, but we will be continually updating and enhancing the eText.

Banterby

The chapters in Parts 1 and 2 are introduced with dialogue from key players at Banterby, a privately owned company that provides AI-powered conversational chatbot services. We wanted to develop the case around an interesting business model that students would want to learn more about. Artificial intelligence has received a lot of attention in the press, but students may not know much about how it’s used in business. AI is currently used in many large corporations, and nearly every organization is planning on more AI integration. You should expect widespread AI adoption in the next ten years. It’s likely that students will be using AI-powered tools as part of their future jobs.

The company started off by providing a few mid-level online retailers with fully automated customer service chatbots. They quickly expanded into online sales generation, managing customer services, and providing these companies with additional customer data collected via their chatbots. Banterby then used their AI chatbots to provide automated mapping and direction services, as well as customized enterprise training.

Over the past year, Banterby has focused on providing AI chatbot services for the *medical* sector. But it hasn’t gone smoothly due to their AI leaking confidential patient data. Now their CEO wants to move into the *social* and *gaming* sectors. She feels they’re a natural fit with their current AI and wouldn’t be as costly as the medical sector expansion was. Her management team is worried they’re expanding too quickly. 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.

The AI experts at Banterby feel that they should expand beyond chatbots into vision systems. They believe that the addition of AI-powered vision systems would allow them to build a strategic advantage in the medical sector using new AI diagnostic and behavioral applications. This would require additional capital but could ensure their long-term survival.

Banterby also faces some ethical dilemmas. First, they have the ability to harvest data from chatbot dialogs and then use that data to generate sales leads for outside clients. But they’re unsure if this is ethical or even legal. The opportunity to generate more income from existing data is tempting.

Second, they have been approached by a dating site that wants to use Banterby's chatbots to increase interaction with users on the dating site. The male users on their site aren't getting enough interaction and are quitting the site. They want to use chatbots to convince them they're talking with other humans. They're worried about potential negative blowback and possibly lawsuits if the users ever find out they were being tricked.

iMed Analytics

iMed Analytics is an embryonic healthcare informatics company that uses AI and machine learning to analyze medical data in the hopes of improving medical outcomes for patients. iMed allows patients to upload medical data from a variety of approved IoT medical devices like smartwatches, smart scales, oximeters, blood pressure monitors, glucose monitors, EKG monitors, smart inhalers, air quality sensors, and so on.

This data is then analyzed using iMed's custom AI and machine learning algorithms specifically designed for patient data. Patients can see their own customized healthcare dashboards and share this data with their doctors. Doctors can continuously monitor patients to see how they respond to new medications, encounter problems, or experience life-threatening events.

Dr. Greg Solomon, a famous oncologist working at Tampa General Hospital, saw the need for a system like iMed during the COVID-19 pandemic. Due to quarantine lockdowns, he was unable to see many of his cancer patients on a regular basis. Some of his patients were genuinely afraid to come in for visits. He wanted a way to provide medical care to his patients even if he couldn't physically see them. iMed, to some extent, made this possible.

iMed is based on a real-world prototype written in C#, and the code runs against an Azure database in the cloud. It uses the Windows Phone emulator that is part of Visual Studio. Dr. Solomon hired Emily Lewis as the information systems manager of his newly formed company and developed a simple prototype he could demonstrate to hospitals and medical practices. He also found and hired a new general manager (Jasmine Moore), customer service manager (Felix Ramos), and machine learning guru (Jose Navarro). 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 has been a shift in students' attitudes about ethics. Students seem, at least many of them, to be more cynical and callous about ethical issues. As a result, in the seventh 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 consult both of those guides.

What to Expect in 2034?

Every chapter concludes with a question labeled "What to Expect in 2034?" This section presents our guesses about how the subject of that chapter is likely to change between now and 2034. Clearly, if we had a crystal ball that would give good answers to that question, we wouldn't be writing textbooks.

However, we make what we believe is a reasonable stab at an answer. You will probably have different ideas, and we hope students will have different ideas as well. The goal of these sections is to prompt students to think, wonder, assess, and project about future technology. These sections usually produce some of the liveliest in-class discussions.

Why Might You Want Your Students to Use SharePoint?

The difficult part of teaching collaboration is knowing how to assess it. Collaboration assessment is not simply finding out which students did the bulk of the work. It also involves assessing feedback and iteration; that is, identifying who provided feedback, who benefited from the feedback, and how well the work product evolved over time.

Microsoft SharePoint is a tool that can help assess collaboration. It automatically maintains detailed records of all changes that have been made to a SharePoint site. It tracks document versions, along with the date, time, and version author. It also maintains records of user activity—who visited the site, how often, what site features they visited, what work they did, what contributions they made, and so forth. SharePoint makes it easy to determine which students were making sincere efforts to collaborate by giving and receiving critical feedback throughout the project assignment, and which students were making a single contribution 5 minutes before midnight the day before the project was due.

Additionally, SharePoint has built-in facilities for team surveys, team wikis, and member blogs, as well as document and list libraries. All of this capability is backed up by a rich and flexible security system. To be clear, we do not use SharePoint to run our classes; we use either Canvas or Blackboard for that purpose. However, we do require students to use SharePoint for their collaborative projects. A side benefit is that they can claim, rightfully, experience and knowledge of using SharePoint in their job interviews.

You might also want to use Microsoft 365 because it includes Skype, hosted Exchange, online storage, and SharePoint Online as an add-on. Microsoft offers Microsoft 365 to academic institutions as a whole or to students directly at reduced educational rates.

Why Are the Chapters Organized by Questions?

The chapters of *Using MIS* are organized by questions. According to Marilla Svinicki,¹³ a leading researcher on student learning at the University of Texas, we should not give reading assignments such as “Read pages 50 through 70.” The reason is that today’s students need help organizing their time. With such a reading assignment, they will fiddle with pages 50 through 70 while texting their friends, surfing the Internet, and listening to their iPods. After 30 or 45 minutes, they will conclude they have fiddled enough and will believe they have completed the assignment.

Instead, Svinicki states we should give students a list of questions and tell them that their job is to answer those questions, treating pages 50 through 70 as a resource for that purpose. When students can answer the questions, they have finished the assignment.

Using that philosophy, every chapter in this text begins with a list of questions. Each major heading in the chapter is one of those questions, and the Active Review at the end of each chapter provides students with a set of actions to take in order to demonstrate that they are able to answer the questions. Since learning this approach from Professor Svinicki, we have used it in our classes and have found that it works exceedingly well.

MyLab MIS for Using MIS 13e

To improve student results, we recommend pairing this textbook with **MyLab MIS**, the teaching and learning platform that combines respected content with personalized engagement to help student see real results. Unmatched in flexibility, MyLab® combines respected content with personalized engagement to help students see real results while developing skills that future employers are seeking in their candidates. From Video Case Studies and real-world decision simulations to **Using AI Projects** and **Dynamic Study Modules**, MyLab MIS helps you channel your teaching style and develop confident learners. It’s the power of MyLab.

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Pearson+ eText: The course eText is accessed directly in your MyLab course. You and your students can dive right into the course eText take notes, make highlights, and review flashcards and even listen to your book at home or on the go with the Pearson+ mobile app.

- **The eText AI Study Tools** are also included giving students unlimited opportunity to achieve proficiency and master key courses concepts anytime, anywhere. Students engage with the study tools for personalized support, simplified explanations, and productive guided practice with an expert chatbot.
- **MIS Headlines** start each chapter and provide a monthly news article to keep you and your students up to date with the technology industry. Each article comes with 2 discussion questions you can use in class or assign through your LMS.
- **Check Your Understanding Questions** at the end of each major chapter section enable students to check their understanding of the material in the section and provide feedback on answer choices.

NEW Using AI Projects provide ready-to-assign activities to teach students how to use generative AI effectively. The projects demonstrate the power of free AI tools and teach the essential skills needed to use AI in school and work. The projects come with grading guidance and rubrics.

NEW Forage Job Simulations: These immersive simulations help students gain valuable job experience with some of the world's top employers. Each simulation showcases a day in the life of a particular role. Students complete a series of task-based scenarios designed to simulate the actual work the company does. Instructors choose which job simulations to assign from the library of offerings.

New Video Case Exercises: A brand new collection of video cases (one per chapter) available in MyLab MIS focus on popular companies and industry news to cover key concepts and experiences in the MIS world. Each video is accompanied by 4 auto-graded multiple-choice questions.

Updated MIS Simulations: Foster critical decision-making skills and engage students with the content. Students to play various roles and make business decisions. The simulations adapt to student's choices and take them on a path based on their decisions with feedback along the way and grading details at the end.

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Dynamic Study Modules help your students stay on track and achieve a higher level of subject-matter mastery. Each module poses a series of questions about a course topic that adapts to each student's performance and offers personalized, targeted feedback to help reinforce their mastery.

Classroom Response Tool (Learning Catalytics) help to increase student engagement and enhance their learning in the classroom. This interactive student response tool allows you to deploy questions and surveys, and assess student comprehension. It also equips you with real-time data to help adjust your instructional strategy on the fly.

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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, a dedicated technical support team is ready to help with the media supplements that accompany this text. Visit <http://support.pearson.com/getsupport> for answers to frequently asked questions and toll-free user support phone numbers.

The following supplements are available with this text:

- Instructor's Resource Manual
- Image Library
- Test Bank
- TestGen® Computerized Test Bank
- PowerPoint Presentation

AACSB Learning Standards Tags

What Is the AACSB?

The Association to Advance Collegiate Schools of Business (AACSB) is a nonprofit corporation of educational institutions, corporations, and other organizations devoted to the promotion and improvement of higher education in business administration and accounting. A collegiate institution offering degrees in business administration or accounting may volunteer for AACSB accreditation review. The AACSB makes initial accreditation decisions and conducts periodic reviews to promote continuous quality improvement in management education. Pearson Education is a proud member of the AACSB and is pleased to provide advice to help you apply AACSB Learning Standards.

What Are AACSB Learning Standards?

One of the criteria for AACSB accreditation is the quality of the curricula. Although no specific courses are required, the AACSB expects a curriculum to include learning experiences in such areas as:

- Communication Abilities
- Ethical Understanding and Reasoning Abilities
- Analytic Skills
- Use of Information Technology
- Dynamics of the Global Economy
- Multicultural and Diversity Understanding
- Reflective Thinking Skills

These seven categories are AACSB Learning Standards. Questions that test skills relevant to these standards are tagged with the appropriate standard. For example, a question testing the moral questions associated with externalities would receive the Ethical Understanding tag.

How Can I Use These Tags?

Tagged questions help you measure whether students are grasping the course content that aligns with AACSB guidelines. In addition, the tagged questions may help to identify potential applications of these skills. This, in turn, may suggest enrichment activities or other educational experiences to help students achieve these goals.

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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 Corporations as well as numerous smaller companies. Recently, David has focused on using information systems for teaching collaboration and teamwork.

His text *Database Processing* was first published in 1977 and is now in its 16th edition. He has authored and coauthored many other textbooks, including *Database Concepts*, 10th ed., *Experiencing MIS*, 10th ed., *SharePoint for Students*, *Office 365 in Business*, and *Processes, Systems, and Information: An Introduction to MIS*, 4th ed.



Randall J. Boyle is a professor of Management Information Systems and a Willard Eccles Fellow at Weber State University. He received his Ph.D. in Management Information Systems from Florida State University in 2003. He also has a master's degree in Public Administration and a B.S. in Finance. He has received university teaching awards at Weber State University, Longwood University, the University of Utah, and the University of Alabama in Huntsville. He has taught a wide variety of classes, including Introduction to MIS, Cyber Security, Networking & Servers, System Analysis and Design, Telecommunications, Advanced Cyber Security, Decision Support Systems, and Web Servers.

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 several textbooks, including *Experiencing MIS*, 10th ed., *Corporate Computer and Network Security*, 6th ed., *Applied Information Security*, 2nd ed., and *Applied Networking Labs*, 2nd ed.

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

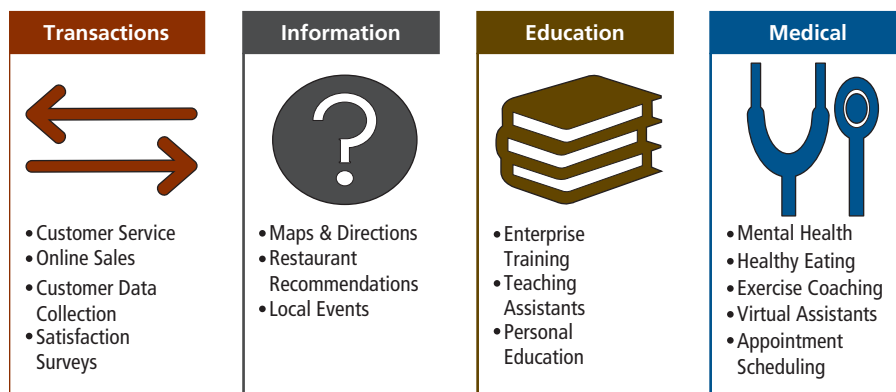
**To Courtney, Noah, Fiona, Layla, and Henry
—Randy Boyle**

Part 1

Why MIS?

Banterby AI is a 7-year-old privately owned company that provides artificial intelligence (AI) conversational chatbot services. The company started off by providing a few mid-level online retailers with fully automated customer service chatbots. They quickly expanded into online sales generation, managing customer services, and providing these companies with additional customer data collected via their chatbots. In two years, their online retail clients saw their personnel costs drop by 30 percent and their sales generation increase by 20 percent.

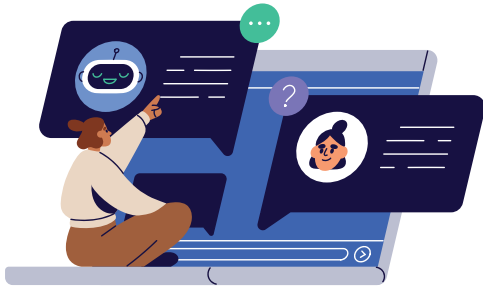
Banterby's success with *transactional* services funded their expansion into *informational* services. Banterby used their AI chatbots to provide automated mapping and direction services to a variety of apps and retailers. They also provided chatbot services for people looking for restaurant recommendations or wanting to attend local events. Revenue generated from the three-year expansion into informational services was a much-needed financial boost. It provided them with the means to enter into the *educational* services market.



In the *educational* services market, Banterby started providing customized enterprise training services. Many of their existing clients immediately signed on to Banterby's fully automated training. The AI bots would automatically onboard new employees, provide mandatory annual training, and manage continuous education for all current employees. Again, Banterby's clients saw immediate savings. Cash flowed into the company, and Banterby added AI-driven teaching assistants and customized personal education.

Over the past year, Banterby has focused on providing AI chatbot services for the *medical* sector, but it hasn't gone smoothly. The security and privacy requirements for medical data are more complex and stringent than for their retail data. Also, the AI-bots have had "sharing" issues that weren't a problem before. With their retail clients, Banterby's AI chatbots would learn from each client and then use that knowledge to resolve problems with the next client. However, in the medical sector, information from one patient must be strictly separated from the next patient. Unfortunately, there were several cases of unanticipated "sharing" of patient information. This is forcing some costly architectural changes in their AI. The initial costs of developing these new AI-powered medical services were much higher than they anticipated.

Overall, the healthcare providers have been very pleased with the automated services for mental health, healthy eating, exercise coaching, virtual assistants, and appointment scheduling.



Source: GoodStudio/Shutterstock

They've seen dramatic cost reductions, efficiency improvements, fewer errors, and greater patient satisfaction.

Banterby's CEO and co-founder is Heidi Akira, a former VP at a mid-sized venture capital (VC) firm in California. Heidi got her MBA from Stanford University and immediately went to work for the VC firm analyzing high-tech startups. She quickly rose within the firm and made vice president in 8 years. She developed a large network of highly skilled engineers and angel investors.

While investigating a startup, she met Aleks Kovalenko. At the time, Aleks was managing a small artificial intelligence startup, working on a groundbreaking machine learning system for robots. Victor was charming, intelligent, 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.

Heidi was asking Aleks about the practical applications of his company's machine learning system and he explained how it could be used to help robots perform many tasks efficiently without massive amounts of code. Aleks was convinced that AI was going to have a bigger impact on the world than the computer chip. He then explained that machine learning was just part of what AI could do. He said another huge market for AI would be *chatbots*.

AI-driven chatbots could automate many of the "talking" jobs. In fact, he said they would be universally used by every organization to reduce personnel costs by at least 30 percent. Most workers do work that is repeatable, consistent, and must follow certain rules or guidelines. These types of jobs can be automated with enough processing power, training data, and modern AI techniques.

That got Heidi thinking. A friend of hers, Pradip Shaan, had just finished graduate school at MIT's Artificial Intelligence and Machine Learning Lab. He had developed some really amazing new AI conversational chatbot techniques that could process training data quickly, cheaply, and produce answers that were correct nearly 70 percent of the time. With some work, he believed he could increase its accuracy even more. Heidi asked Aleks if he would have lunch with her and Pradip the following week. Heidi had an idea.

At lunch Heidi pitched Aleks and Pradip on the Banterby idea, and the company was born a few months later. Fast forward 7 years, Banterby now has over 60 corporate clients with revenues of about \$35 million a year. Heidi, Banterby's CEO, wanted to grow the company more quickly by moving into the medical sector. However, expansion into the medical sector was far more costly and difficult than she anticipated. Aleks is worried that they're moving too quickly. The architectural changes that had to be made were expensive and, at times, frustrating.

Now Heidi wants to move into the *social* and *gaming* sectors. She feels they're a natural fit with their current AI and wouldn't be as costly as the medical sector expansion was. Aleks isn't convinced. He feels like they should wait before expanding the business. They don't have the money on hand or the people to start a major expansion like the one Heidi is thinking about. Plus, he thinks there are additional diagnostic and behavioral applications that could be developed within the medical sector.

Heidi says they could move quickly if they took on additional debt or new investors. Heidi points out to Aleks that their revenues look strong, the investors are willing to put in more funding, and Pradip said the expansion would "probably" go well.

The Importance of MIS

"Welcome to Banterby," Heidi, the CEO of Banterby, says with a warm smile as she welcomes her new Chief Marketing Officer Nyree Beau. "We're glad to have you here. We've heard great things about your work at Salesforce. We hope you can do the same thing for us here at Banterby."

Eva, the Director of Sales, motions to their newly-hired CMO, Nyree, to sit down. "Yes, you come highly recommended by your prior boss. He said you're very creative and understand how to sell online services."

"That's very kind of you to say," Nyree says with a noticeable Australian accent. "I think Salesforce and Banterby have a lot in common. They're both great services that are obvious choices for companies. After adopting Salesforce, most companies saw revenues go up by 25 percent, customer satisfaction go up by 35 percent, and Marketing ROI go up by 30 percent. Marketing Salesforce was easy. We just had to educate customers on how much their revenues would go up."

Heidi looks approvingly at Eva, and then leans forward in her chair. "That's awesome. I think you'll find that Banterby will be easy to market as well. It really sells itself." Heidi smiles broadly, looks over at Eva, and winks.



Generated via Shutterstock AI

Eva laughs, "Well, it doesn't exactly sell itself. I still have to put in some work. In fact, it's kind of a tricky service to sell."

"How so?" Nyree asks with sincere interest.

"Well," Eva starts cautiously, "When you sold Salesforce, you told management that they'd have to hire or train some new customer service representatives, but that increases in sales revenue and customer satisfaction would easily offset any costs. Right?"

"Yes, and it worked out that way every time. Everyone won. Management loved us, customer service improved, and the employees' jobs were easier."

"Well, it's a little different with Banterby," Eva looks at Heidi and then back at Nyree. "Revenue goes up substantially. Management loves that, and customers do have better experiences. But the one issue is personnel reduction. We typically make at least 30 percent of positions redundant."



“Our AI can do many of the jobs currently done by humans, at a fraction of the cost.”

Source: Red Vector/Shutterstock

Heidi looks at the puzzled look on Nyree’s face and says, “Yes, that means most of our corporate customers layoff a large part of their workforce after adopting Banterby. Our AI can do many of the jobs currently done by humans at a fraction of the cost.”

Eva jumps in, “That’s the tricky part. Management absolutely loves us. Revenue jumps, and labor costs drop like a rock. Their stock price skyrockets and they all get bonuses. But on the other hand, to employees, it’s like we’re the grim reaper. I understand why they’re mad, but their company has to adopt AI services. It’s strategically necessary. If they don’t, their competitors will.”

Heidi smiles reassuringly, “There are ways to make the transition to automated services easier for everyone. We encourage our corporate customers to offer their employees additional paid technical training as part of their severance package. Some offer it, others don’t. It’s up to them.”

Nyree asks cautiously, “Why offer technical training to the people being laid off? What if they want non-technical training?”

“Well,” Heidi says in a logical tone, “they need to transition to a job that will exist for the next 20 years. Between AI and robotics, nearly all of the non-technical jobs will be automated. Sure, there will still be some non-technical jobs, but there won’t be that many.”

Eva chimes in, “Yeah, that’s what we do. We automate, and we’re getting better at it every day. We get more processing power, better data, and better algorithms all the time. Our AI is more accurate, more consistent, and more reliable than most humans, at a lot of tasks.”

Heidi nods in agreement, “True. If you think about it, the real dilemma facing companies is what if they don’t adopt AI services? How can they compete against companies that have adopted AI? They’d be facing an economic battle with companies that have dramatically lower operating costs, much higher revenues, and much better products. AI and technical innovation will become strategically vital to their survival.”

“It already is,” Eva interjects.

Chapter Preview

“Our AI can do many of the jobs currently done by humans, at a fraction of the cost.”

Do you find that statement sobering? Considering the rapid pace of automation, what type of work will you be doing in 10, 20, or 30 years? We’ll begin this book by discussing the key skills that you need and explaining why this course is the single best course in the business school for teaching you those key skills.

You may find that last statement surprising. If you are like most students, you have no clear idea of what your MIS class will be about. If someone were to ask you, “What do you study in that class?” you might respond that the class has something to do with computers and maybe computer programming. Beyond that, you might be hard-pressed to say more. You might add, “Well, it has something to do with computers in business,” or maybe, “We are going to learn to solve business problems with computers using spreadsheets and other programs.” So, how could this course be the most important one in the business school?

We begin with that question. After you understand how important this class will be to your career, we will discuss fundamental concepts. We’ll wrap up with some practice on one of the key skills you need to learn.

Study Questions

- Q1-1** Why is Introduction to MIS the most important class in the business school?
- Q1-2** How will MIS affect you?
- Q1-3** What is MIS?
- Q1-4** How can you use the five-component model?
- Q1-5** What is information?
- Q1-6** What are the necessary data characteristics?
- Q1-7** What to expect in 2034?

Q1-1 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 few decades ago, majoring in "computers" was considered a nerdy thing to do. 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 about \$2.48T. The second largest IPO offering in history (\$25B) came from the online e-commerce 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 übercool?

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 that 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 about factories, bureaucracies, mass production, and operational efficiency. However, 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, 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 has become a primary driver of corporate profitability. 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 by 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

Information Age

A period in history where the production, distribution, and control of information is the primary driver of the economy.

Digital Revolution

The conversion from mechanical and analog devices to digital devices.

Bell's Law

A new computer class forms roughly each decade, establishing a new industry.

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 mph. 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 of 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

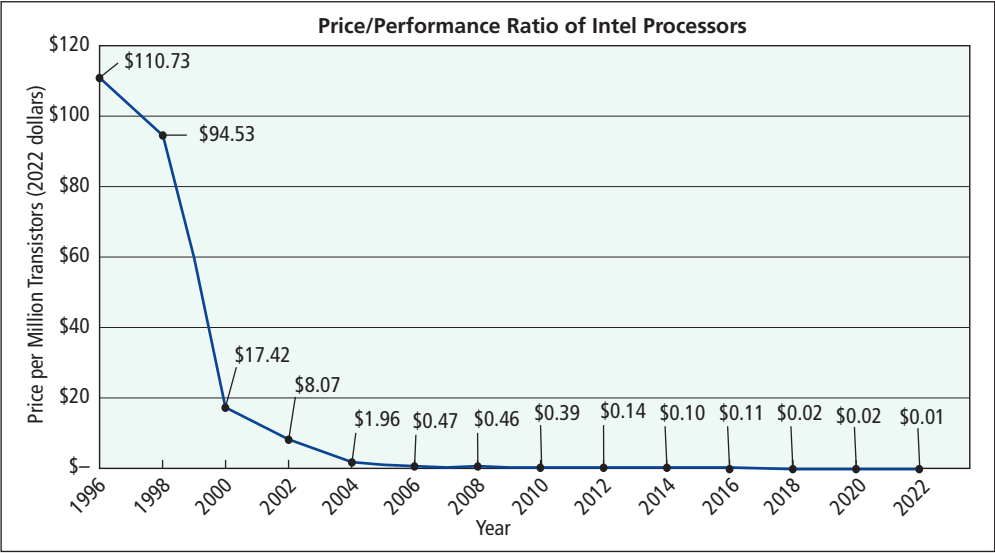
In 1965, Gordon Moore, cofounder of Intel Corporation, stated that because of technology improvements in electronic chip design and manufacturing, "The number of transistors per square inch on an integrated chip doubles every 18 months." This became known as **Moore's Law**. His statement has been commonly 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 2022, that price had fallen to \$0.01 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 platforms. In fact, most tech companies would not exist today if processing power hadn't increased exponentially.

Moore's Law
A law, created by Gordon Moore, stating that the number of transistors per square inch on an integrated chip doubles every 18 months.

Figure 1-1 Computer Price/Performance Ratio Decreases

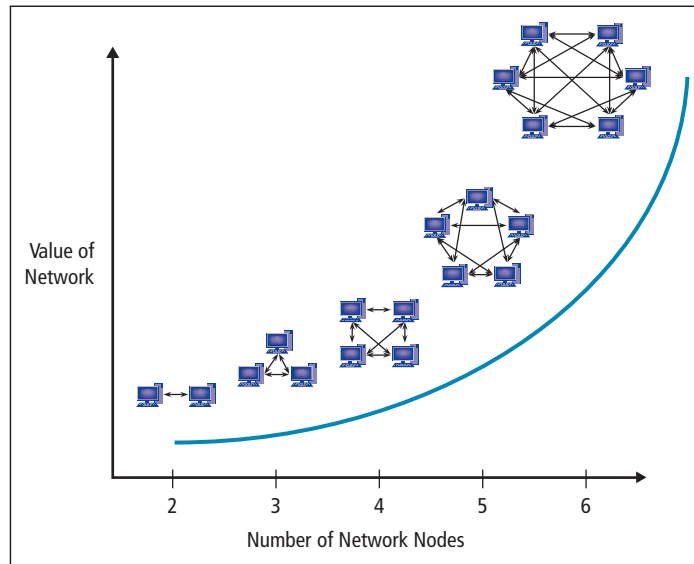
Source: © Based on data from ark.intel.com#@Processors and techpowerup.com



As a future business professional, however, you needn't care how fast 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.

Metcalfé's Law

Another fundamental force that is changing digital devices is Metcalfe's Law, named after Robert Metcalfe, the inventor of Ethernet. **Metcalfé'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.



Metcalfé's Law

The value of a network is equal to the square of the number of users connected to it.

Figure 1-2 Increasing Value of Networks

Metcalfé'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 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's also power consumption, image resolution, and interconnectivity between devices, all of which are changing, too. And this isn't a complete list.

Nielsen's Law

Network connection speeds for high-end users will increase by 50 percent per year.

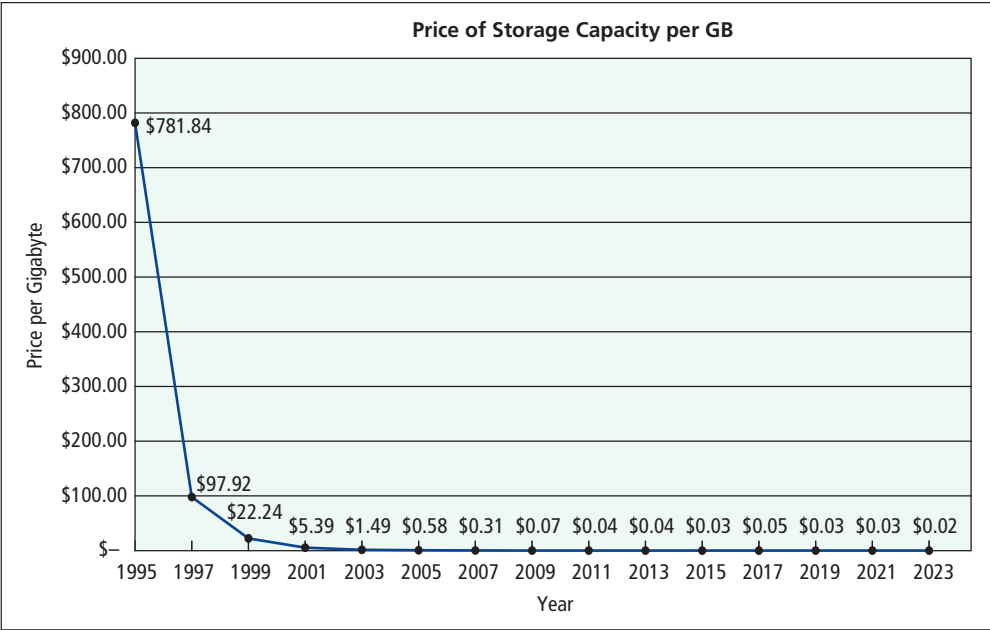
Kryder's Law

The storage density on magnetic disks is increasing at an exponential rate.

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.
Metcalf'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.

Figure 1-4 Price of Storage Capacity per GB



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.



Q1-2 How Will MIS Affect You?

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 You 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, a recent study by McKinsey & Company looked at how workers' skills will have to shift due to Artificial Intelligence (AI) and automation. They note that the demand for technological skills will grow by 55 percent by 2030, while other skills like physical (-14 percent) and basic cognitive (-15 percent) will decrease.⁴ Some higher cognitive skills, like creativity (40 percent) and critical thinking (17 percent), will see greater use.

Robert Reich, former Secretary of Labor, enumerates four additional nonroutine cognitive skills that workers in the 21st century will need: abstract reasoning, systems thinking, collaboration, and the ability to experiment.⁵

Whether you're majoring in accounting, marketing, finance, or information systems, you will need to develop strong *technical* and *nonroutine cognitive* skills. These are skills that AI and robots can't do well. These skills will help future-proof your job from automation. McKinsey & Company estimates that 15 percent of the global workforce (400 million workers) will be displaced by 2030.⁶

Figure 1-5 shows an example of each nonroutine cognitive skill. The Banterby case at the start of this chapter is a good illustration of how necessary these skills are. Banterby is a company that is focused on automation, yet all of these key skills are used by their employees. Routine tasks can be easily automated, but high-level nonroutine cognitive tasks cannot. These are the skills that you will need as technology changes over time.

How Can Intro to MIS Help You Learn Nonroutine Cognitive Skills?

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

Figure 1-5 Examples of Nonroutine Cognitive Skills

Skill	Example	Example at Banterby
Abstract Reasoning	Construct a model or representation.	Conceptualizing a method for using AI and machine learning.
Critical Thinking	Analyze facts using rational thinking to form a judgment that will achieve a satisfactory result.	Think about how rapidly Banterby can expand while maintaining profitability.
Systems Thinking	Model system components and show how components' inputs and outputs relate to one another.	Ability to model Banterby's operational needs.
Creativity	Generate new ideas or alternatives that can be used to solve unique problems.	Find a new use for AI chatbots in the healthcare sector.
Ability to Experiment	Test promising new alternatives, consistent with available resources.	Test using existing AI chatbots to automate account renewals at hospitals.
Collaboration	Develop ideas and plans with others. Provide and receive critical feedback.	Willingness to work with others on a new AI implementation.

Abstract reasoning
The ability to make and manipulate models.

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.

Critical thinking
The ability to analyze facts using rational thinking to form a judgment that will achieve a satisfactory result.

Critical Thinking

Critical thinking is the ability to analyze facts using rational thinking to form a judgment that will achieve a satisfactory result. This class will focus on critically thinking about how technology will impact the companies you will work for. A new technology may pose a strategic threat or a tremendous opportunity. It could even be both. But you'll need to use critical thinking to know why it is either a threat or opportunity.

For example, in Chapter 6, you will look at the advantages and disadvantages of hosting data in the cloud versus locally in a data center. You need to be able to form a judgment about why one way is better than the other. How could costs, security, and scalability affect your decision to use the cloud? Lower hosting costs could be a huge opportunity, but getting your data stolen would be a major threat.

This class will help you evaluate the impact of technology on companies and then form rational judgments about them that will guide your decision-making.

Systems thinking
the mental activity of making one or more models of the components of a system and connecting the inputs and outputs among those components into a sensible whole, one that explains the phenomenon observed

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, connect the inputs and outputs among those components into a sensible whole that reflects the structure and dynamics of the observed 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, compare alternative systems, and apply different systems to different situations. All of those tasks will prepare you for systems thinking as a professional.

Creativity

Creativity is the ability to generate new ideas or alternatives that can be used to solve unique problems. Creativity isn't just about paintings, sculptures, or music. Creativity can come in many forms. In the context of business, it's about finding new ways of solving problems. This class will show you how technology can be used to solve a variety of problems.

For example, prior to 1980, people mostly watched movies in movie theatres. But a new innovation, the VHS tape, allowed consumers to watch movies at home. Technology shifted again in about 2002 when consumers switched to DVDs. But in 2007, someone at Netflix had the great idea that it might be possible to stream movies over the Internet. Netflix launched their streaming service, and from 2010 to 2023, the value of the company grew from \$2B to over \$168B.

History is full of stories about creative people generating new ideas that then turned into successful companies. Creativity and innovation are the sources of exponential growth in companies. This class will show you how these creative tech innovations have changed businesses, markets, and society.

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. 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** involves 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 Canvas or 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.

Collaboration

Collaboration is the activity of two or more people working together to achieve a common goal, result, or work product. Chapter 7 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 that the single most important skill for effective collaboration is to give and receive critical feedback. Advance a proposal in business that challenges the cherished

Creativity

The ability to generate new ideas or alternatives that can be used to solve unique problems.

Experimentation

A careful and reasoned analysis of an opportunity, envisioning potential products or solutions or applications of technology and then developing those ideas that seem to have the most promise, consistent with the resources you have.

Collaboration

The activity of two or more people working together to achieve a common goal via a process of feedback and iteration.

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.

Jobs

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 4,777 CEOs in 2023. It found that 73 percent of CEOs are prioritizing AI over all other digital investments in an effort to improve operational efficiency. They believe that 40 percent of all human working hours will be supported by AI.⁷ In other words, your future job will likely involve using and working with AI.

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.

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 2021 were management, computer and mathematical, legal, architecture and engineering, and business and financial operations. Projected job growth in computer and mathematical jobs (15.4 percent) was more than double the average for all occupations (5.3 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**.

Technology skills gap
The mismatch between the high level of tech skills demanded by employers and the low level of tech skills held by employees.

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

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

Occupations	2020 Median Wage	2021 Median Wage	2022 Median Wage	2021–31 Percent Job Growth
Management	\$ 109,760	\$ 102,450	\$ 116,880	5.4
Computer and mathematical	\$ 91,350	\$ 97,540	\$ 104,200	15.2
Legal	\$ 84,910	\$ 82,430	\$ 99,220	5.9
Architecture and engineering	\$ 83,160	\$ 79,840	\$ 91,420	5.2
Healthcare practitioners and technical	\$ 69,870	\$ 75,040	\$ 80,820	8.0
Business and financial operations	\$ 72,250	\$ 76,570	\$ 79,050	5.6
Life, physical, and social science	\$ 69,760	\$ 72,740	\$ 78,280	6.1
Education, training, and library	\$ 52,380	\$ 57,220	\$ 59,940	2.3
Arts, design, entertainment, sports, and media	\$ 53,150	\$ 51,190	\$ 58,920	3.8
Construction and extraction	\$ 48,610	\$ 48,210	\$ 55,680	2.5
Installation, maintenance, and repair	\$ 48,750	\$ 47,940	\$ 53,920	3.6
Community and social service	\$ 47,520	\$ 48,410	\$ 52,000	7.8
All occupations	\$ 41,950	\$ 45,760	\$ 48,060	2.8
Protective service	\$ 43,710	\$ 46,590	\$ 47,760	0.3
Office and administrative support	\$ 38,720	\$ 38,050	\$ 44,480	–6.2
Production	\$ 37,440	\$ 37,710	\$ 43,630	–3.2
Transportation and material moving	\$ 34,080	\$ 36,860	\$ 40,050	5.4
Sales and related	\$ 31,500	\$ 30,600	\$ 36,760	–2.6
Healthcare support	\$ 29,960	\$ 29,880	\$ 36,140	15.4
Building and grounds cleaning and maintenance	\$ 29,940	\$ 30,240	\$ 35,990	1.7
Farming, fishing, and forestry	\$ 29,670	\$ 29,860	\$ 35,520	–1.9
Personal care and service	\$ 28,120	\$ 29,450	\$ 34,260	6.1
Food preparation and serving related	\$ 25,500	\$ 28,400	\$ 32,240	1.7

Figure 1-7 shows a more detailed breakdown of salary growth from 2019 to 2021 for specific subcategories under business managers, computer and information technology, and other business occupations. It also shows job growth projections for the years 2021 to 2031.⁸ Growth rates of all information systems–related jobs are at or above the 5 percent average for all occupations. Some are growing many times faster.

	2021 Median Pay	2022 Median Pay	2023 Median Pay	Job Growth (%) 2022–32	Job Growth (N) 2022–32
Business Managers					
Information Systems Managers	\$ 159,010	\$ 164,070	\$ 169,510	15%	86,000
Marketing Managers	\$ 133,380	\$ 140,040	\$ 156,580	6%	24,300
Financial Managers	\$ 131,710	\$ 139,790	\$ 156,100	16%	126,600
Sales Managers	\$ 127,490	\$ 130,600	\$ 135,160	4%	22,500
Human Resources Managers	\$ 126,230	\$ 130,000	\$ 136,350	5%	10,000
Computer and Information Technology					
Computer Network Architects	\$ 120,520	\$ 126,900	\$ 129,840	4%	6,300
Software Developers	\$ 109,020	\$ 127,260	\$ 130,160	25%	451,200
Information Security Analysts	\$ 102,600	\$ 112,000	\$ 120,360	32%	53,200
Database Administrators	\$ 101,000	\$ 99,890	\$ 117,450	8%	12,300
Computer Systems Analysts	\$ 99,270	\$ 102,240	\$ 103,800	10%	51,100
Network and Systems Administration	\$ 80,600	\$ 90,520	\$ 95,360	2%	8,300
Web Developers	\$ 78,300	\$ 78,580	\$ 92,750	16%	34,700
Business Occupations					
Financial Analysts	\$ 95,570	\$ 95,080	\$ 99,890	8%	29,000
Management Analysts	\$ 93,000	\$ 95,290	\$ 99,410	10%	95,700
Accountants and Auditors	\$ 77,250	\$ 78,000	\$ 79,880	4%	67,400
Logisticians	\$ 77,030	\$ 77,520	\$ 79,400	18%	38,300
Market Research Analysts	\$ 63,920	\$ 68,230	\$ 74,680	13%	116,600
Human Resources Specialists	\$ 62,290	\$ 64,240	\$ 67,650	6%	51,400

Figure 1-7 Bureau of Labor Statistics Occupational Outlook 2021–2031

Source: Based on Bureau of Labor Statistics, U.S. Department of Labor, “Occupational Projections and Worker Characteristics,” Occupational Outlook Handbook, accessed May 27, 2023, www.bls.gov/ooh.

For example, plentiful, high-paying jobs are available to business professionals who know how to use information systems to improve business process quality, or 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 Career Guide for more thoughts on why you might consider an IS-related job.

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

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.

Management information systems

The management and use of information systems that help organizations achieve their strategies.

Information system (IS)

A group of hardware, software, data, procedure, and people components that interacts to produce information.

Information technology (IT)

The products, methods, inventions, and standards used for the purpose of producing information.

System

A group of components that interacts to achieve some purpose.

Five-component framework

The five fundamental components of an information system—computer hardware, software, data, procedures, and people—present in every information system, from the simplest to the most complex.

Computer hardware

Electronic components and related gadgetry that input, process, output, store, and communicate data according to the instructions encoded in computer programs or software. One of the five fundamental components of an information system.

Software

Instructions for computers. One of the five fundamental components of an information system.

Data

Recorded facts or figures. One of the five fundamental components of an information system.



Q1-3 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, license programs and databases, and 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. However, you 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 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.

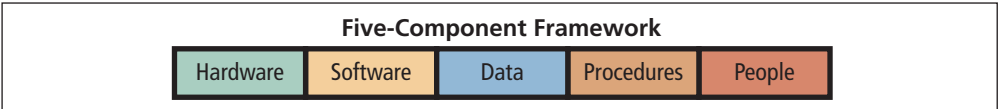
The definition of MIS has three key elements: *management and use*, *information systems*, and *strategies*. Let’s consider each, starting first with information systems and their components.

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 interact 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).

Figure 1-8 Five Components of an Information System



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.

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.

As we will discuss later in this chapter, these five components also mean that many different skills are required besides those of hardware technicians or computer programmers when building or using an information system.

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 of 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 a *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 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.

Procedures

Instructions for humans.

One of the five fundamental components of an information system.

People

As part of the five-component framework, one of the five fundamental components of an information system; includes those who operate and service the computers, those who maintain the data, those who support the networks, and those who use the system. Information exists only in the minds of people.

Computer-based information system

An information system that includes a computer.

Security is critically important when using information systems today. You'll learn much more about it in Chapter 10. But you need to know about strong passwords and their use now, before you get to that chapter. Read and follow the Security Guide.