

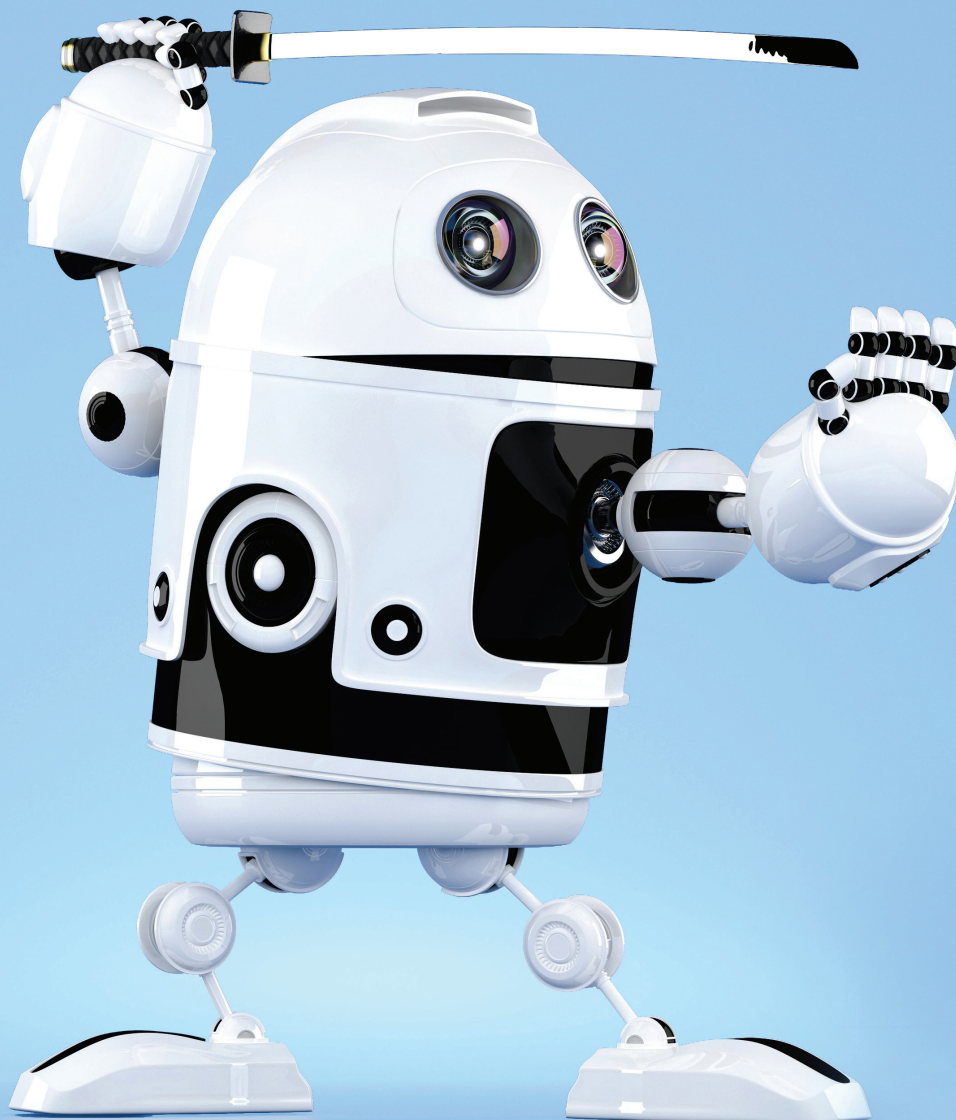
GLOBAL
EDITION 

Technology in Action

Complete

SIXTEENTH EDITION

Alan Evans • Kendall Martin • Mary Anne Poatsy



Don't just read about technology, interact with it.

HELPDESKS

These highly-interactive, almost game-like simulations let you take the role of a helpdesk staffer where you answer computer technology questions from customers. These simulations help reinforce the book content in a fun, engaging way.

CHAPTER 1

Technology Impacts
The Impact of Artificial
Intelligence

CHAPTER 2

Understanding Bits
and Bytes
Exploring Storage
Devices and Ports

CHAPTER 3

Doing Business
Online
Evaluating Websites

CHAPTER 4

Buying and Installing
Software
Choosing Software

CHAPTER 5

Starting the
Computer: The
Boot Process
Organizing Your
Computer:
File Management

CHAPTER 6

Evaluating Your CPU
and RAM
Evaluating Computer
System
Components

CHAPTER 7

Understanding
Networking
Managing and
Securing Wireless
Networks

CHAPTER 8

Managing Digital
Media
Understanding
Intellectual Property
and Copyright

CHAPTER 9

Threats to Your
Digital Life
Understanding
Firewalls

CHAPTER 10

Understanding
Software
Programming
A Variety of
Programming
Languages

CHAPTER 11

Using Databases
How Businesses
Use Databases

CHAPTER 12

Using Servers
Transmission Media
and Network
Adapters

CHAPTER 13

Understanding IP
Addresses, Domain
Names, and
Protocols
Keeping E-Mail
Secure

SOUND BYTES

These multimedia lessons demystify complex computer concepts with short audio, animation, or video. The Sound Bytes now also include integrated learning objectives, a summary, and a quiz.

CHAPTER 1

Virtual Computer
Tour
How to Debate
Ethical Issues

CHAPTER 2

Binary Numbers
Interactive
Smartphone Are
Really Smart

CHAPTER 3

Blogging
Finding Information
on the Web

CHAPTER 4

Where Does Binary
Show Up?
Programming for
End Users

CHAPTER 5

Using Windows
Task Manager to
Evaluate System
Performance
Hard Disk Anatomy

CHAPTER 6

Installing RAM
Installing an SSD
Drive

CHAPTER 7

Installing a Home
Computer
Network
Securing Wireless
Networks

CHAPTER 8

Enhancing Photos
with Image-Editing
Software
Plagiarism and
Intellectual
Property

CHAPTER 9

Protecting Your
Computer
Managing Computer
Security with
Windows Tools

CHAPTER 10

Using the Arduino
Microcontroller
Programming with
the Processing
Language

CHAPTER 11

Creating and
Querying an
Access Database
Analyzing Data with
Microsoft Power
BI Suite

CHAPTER 12

Network Topology
and Navigation
Devices
A Day in the Life
of a Network
Technician

CHAPTER 13

Creating Web Pages
with Squarespace
Client-Side
Web Page
Development

IT SIMULATIONS

IT Simulations are detailed, interactive scenarios covering the core chapter topic. Students work through the simulations to apply what they have learned and demonstrate understanding in an active learning environment.

CHAPTER 1

Technology and
Ethics

CHAPTER 2

What Is
a Computer?

CHAPTER 3

The Internet

CHAPTER 4

Application Software

CHAPTER 5

System Software

CHAPTER 6

Hardware

CHAPTER 7

Networks

CHAPTER 8

Digital Devices
and Multimedia

CHAPTER 9

Security and
Privacy

CHAPTER 10

Program
Development

CHAPTER 11

Databases

CHAPTER 12

Client/Server
Networks

CHAPTER 13

Communicating,
Sharing on
the Web

16th Edition
Global Edition

Technology in Action

Complete

Alan Evans • Kendall Martin • Mary Anne Poatsy



Vice President, Career & IT Skills: Andrew Gilfillan
Executive Portfolio Manager: Jenifer Niles
Managing Producer: Laura Burgess
Development Editor: Shannon LeMay-Finn
Associate Editor, Global Edition: Aurko Mitra
Director of Product Marketing: Brad Parkins
Director of Field Marketing: Jonathan Cottrell
Field Marketing Manager: Bob Nisbet
Product Marketing Manager: Heather Taylor
Operations Specialist: Maura Garcia
Senior Product Model Manager: Eric Hakanson

Lead, Production and Digital Studio: Heather Darby
Senior Manufacturing Controller, Global Edition:
Caterina Pellegrino
Course Producer: Amanda Losonsky
Digital Content Producer: Tanika Henderson
Media Production Manager, Global Edition: Vikram Kumar
Senior Art Director: Mary Siener
Cover Design: SPi Global
Cover Image Credits: kirill_makarov/Shutterstock
Text Font: 10/12 Helvetica Neue LT W1G Roman

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on the appropriate page within text.

Microsoft and/or its respective suppliers make no representations about the suitability of the information contained in the documents and related graphics published as part of the services for any purpose. All such documents and related graphics, are provided “as is” without warranty of any kind. Microsoft and/or its respective suppliers hereby disclaim all warranties and conditions with regard to this information, including all warranties and conditions of merchantability, whether express, implied or statutory, fitness for a particular purpose, title and non-infringement. In no event shall Microsoft and/or its respective suppliers be liable for any special, indirect or consequential damages or any damages whatsoever resulting from loss of use, data or profits, whether in an action of contract, negligence or other tortious action, arising out of or in connection with the use or performance of information available from the services.

The documents and related graphics contained herein could include technical inaccuracies or typographical errors. Changes are periodically added to the information herein. Microsoft and/or its respective suppliers may make improvements and/or changes in the product(s) and/or the program(s) described herein at any time. Partial screen shots may be viewed in full within the software version specified.

Microsoft®, Windows®, and Microsoft Office® are registered trademarks of the Microsoft Corporation in the U.S.A. and other countries.

Pearson Education Limited

KAO Two
KAO Park
Hockham Way
Harlow
Essex
CM17 9SR
United Kingdom

and Associated Companies throughout the world

Visit us on the World Wide Web at: www.pearsonglobaleditions.com

© Pearson Education Limited 2021

The rights of Alan Evans, Kendall Martin, and Mary Anne Poatsy to be identified as the authors of this work, have been asserted by them in accordance with the Copyright, Designs and Patents Act 1988.

Authorized adaptation from the United States edition, entitled Technology in Action Complete, 16th Edition, ISBN 978-0-13-543519-9 by Alan Evans, Kendall Martin, and Mary Anne Poatsy, published by Pearson Education ©2020.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without either the prior written permission of the publisher or a license permitting restricted copying in the United Kingdom issued by the Copyright Licensing Agency Ltd, Saffron House, 6–10 Kirby Street, London EC1N 8TS.

All trademarks used herein are the property of their respective owners. The use of any trademark in this text does not vest in the author or publisher any trademark ownership rights in such trademarks, nor does the use of such trademarks imply any affiliation with or endorsement of this book by such owners. For information regarding permissions, request forms, and the appropriate contacts within the Pearson Education Global Rights and Permissions department, please visit www.pearsoned.com/permissions/.

This eBook is a standalone product and may or may not include all assets that were part of the print version. It also does not provide access to other Pearson digital products like MyLab and Mastering. The publisher reserves the right to remove any material in this eBook at any time.

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

ISBN 10: 1-292-34962-X

ISBN 13: 978-1-292-34962-6

eBook ISBN 13: 978-1-292-34963-3

Typeset by SPi Global

Contents at a Glance

Chapter 1

The Impact of Technology in a Changing World 30

Chapter 2

Looking at Computers: Understanding the Parts 64

Chapter 3

Using the Internet: Making the Most of the Web's Resources 108

Chapter 4

Application Software: Programs That Let You Work and Play 148

Chapter 5

System Software: The Operating System, Utility Programs, and File Management 186

Chapter 6

Understanding and Assessing Hardware: Evaluating Your System 226

Chapter 7

Networking: Connecting Computing Devices 268

Chapter 8

Managing Your Digital Lifestyle: Challenges and Ethics 300

Chapter 9

Securing Your System: Protecting Your Digital Data and Devices 350

Chapter 10

Behind the Scenes: Software Programming 396

Chapter 11

Behind the Scenes: Databases and Information Systems 440

Chapter 12

Behind the Scenes: Networking and Security in the Business World 484

Chapter 13

Behind the Scenes: How the Internet Works 526

Appendix A

The History of the Personal Computer 564

Appendix B

Careers in IT 576

Glossary 590

Index 608

Contents

Chapter 1

The Impact of Technology in a Changing World 30

Part 1: Technology in Society 32

Learning Outcome 1.1 You will be able to discuss the impact of the tools of modern technology on national and global issues.

Technology in a Global Society 32

Impact of Tools of Modern Technology 32

Objective 1.1 Describe various technological tools being used to impact national and global issues.

Global Issues 33

Objective 1.2 Describe various global social issues that are being affected by technology.

Technology Connects Us with Others 34

Technology Impacts How and Why We Connect and Collaborate 34

Objective 1.3 Describe how technology is changing how and why we connect and collaborate with others.

Technology Impacts How We Consume 35

Objective 1.4 Summarize how technology has impacted the way we choose and consume products and services.

The Importance of Computer Literacy 36

Computer Literacy 36

Objective 1.5 Characterize computer literacy and explain why it is important to be computer literate.

HELPDESK: Technology Impacts 36

SOUND BYTE: Virtual Computer Tour 37

TRY THIS: What Does Facebook Know about You? 39

MAKE THIS: TOOL: IFTTT.com (If This Then That) 40

Part 2: Emerging Technologies and Ethical Computing 41

Learning Outcome 1.2 You will be able to describe emerging technologies, such as artificial intelligence, and how technology creates new ethical debates.

Artificial Intelligence 41

Artificial Intelligence Basics 41

Objective 1.6 Describe artificial intelligence systems and explain their main goals.

HELPDESK: The Impact of Artificial Intelligence 41

ETHICS IN IT: Ethics in Computing 44

Working with Artificial Intelligence and Other Information Technologies 45

Technology and Your Career 45

Objective 1.7 Describe how artificial intelligence and other emerging technologies are important in many careers.

BITS&BYTES: Is It AI or Human? Take a Turing Test! 47

DIG DEEPER: XR Extended Reality 49

Ethical Computing 50

Defining Ethics 50

Objective 1.8 Define ethics and examine various ethical systems.

SOUND BYTE: How to Debate Ethical Issues 50

Personal Ethics 51

Objective 1.9 Describe influences on the development of your personal ethics.

Ethics and Technology 53

Objective 1.10 Present examples of how technology creates ethical challenges.

SOLVE THIS: How Technology Is Used on the World Stage and in Your Personal Life 63

Chapter 2

Looking at Computers: Understanding the Parts 64

Part 1: Understanding Digital Components 66

Learning Outcome 2.1 You will be able to describe the devices that make up a computer system.

Understanding Your Computer 66

Computers Are Data Processing Devices 66

Objective 2.1 Describe the four main functions of a computer system and how they interact with data and information.

Binary: The Language of Computers 67

Objective 2.2 Define bits and bytes, and describe how they are measured, used, and processed.

SOUND BYTE: Binary Numbers Interactive 67

Types of Computers 69

Objective 2.3 List common types of computers, and discuss their main features.

ACTIVE HELPDESK: Understanding Bits and Bytes 69

BITS&BYTES: Today's Supercomputers: Faster Than Ever 73

Input Devices 73

Physical Keyboards and Touch Screens 73

Objective 2.4 Identify the main types of keyboards and touch screens.

Mice and Other Pointing Devices 75

Objective 2.5 Describe the main types of mice and pointing devices.

DIG DEEPER: How Touch Screens Work 76

BITS&BYTES: Distributed Computing: Putting Your Computer to Work While You Sleep 77

Image, Sound, and Sensor Input 77

Objective 2.6 Explain how images, sounds, and sensor data are input into computing devices.

Output Devices 79

Image and Audio Output 79

Objective 2.7 Describe options for outputting images and audio from computing devices.

BITS&BYTES: Foldable Phones Are Here 81

Printers 81

Objective 2.8 Describe various types of printers, and explain when you would use them.

BITS&BYTES: CPUs That Fight Back 84

TRY THIS: What's Inside My Computer? 86

MAKE THIS: TOOL: App Inventor 2 or Thinkable 87

Part 2: Processing, Storage, and Connectivity 88

Learning Outcome 2.2 You will be able to describe how computers process and store data and how devices connect to a computer system.

Processing and Memory on the Motherboard 88

The Motherboard and Memory 88

Objective 2.9 Describe the functions of the motherboard and RAM.

SOUND BYTE: Smartphones Are Really Smart 89

Processing 89

Objective 2.10 Explain the main functions of the CPU.

Storing Data and Information 90

Storage Options on Computing Devices 90

Objective 2.11 Describe the various means of storing data and information with computing devices.

ETHICS IN IT: What Is Ethical Computing? 92

TRENDS IN IT: Green Computing (Green IT) 93

Connecting Peripherals to the Computer 94

Computer Ports 94

Objective 2.12 Describe common types of ports used today.

HELPDESK: Exploring Storage Devices and Ports 94

Power Management and Ergonomics	95
Power Controls and Power Management	95
Objective 2.13 Describe how to manage power consumption on computing devices.	
Setting It All Up: Ergonomics	97
Objective 2.14 Define ergonomics, and discuss the ideal physical setup for using computing devices.	
BITS&BYTES: Coming Soon: USB 4 and DisplayPort 2	97
SOLVE THIS: Technology Wish List	107

Chapter 3

Using the Internet: Making the Most of the Web's Resources 108

Part 1: Collaborating and Working on the Web 110

Learning Outcome 3.1 You will be able to explain how the Internet works and how it is used for collaboration, communication, commerce, and entertainment purposes.

The Internet and How It Works 110

The Origin of the Internet 110

Objective 3.1 Describe how the Internet got its start.

How the Internet Works 112

Objective 3.2 Explain how data travels on the Internet.

Collaborating and Communicating on the Web 113

Collaborating with Web Technologies 113

Objective 3.3 Evaluate the tools and technologies used to collaborate on the web.

BITS&BYTES: Secure Messaging Apps 115

SOUND BYTE: Blogging 115

Communicating over the Web 117

Objective 3.4 Summarize the technologies used to communicate over the web.

Conducting Business on the Web 120

Conducting Business Online 120

Objective 3.5 Describe how business is conducted using the Internet.

E-Commerce Safeguards 120

Objective 3.6 Summarize precautions you should take when doing business online.

DIG DEEPER: How Cloud Computing Works 121

BITS&BYTES: Looking for Extra Money? Try a Side Hustle 122

HELPDESK: Doing Business Online 123

BITS&BYTES: Bitcoin: A Form of Virtual Currency 123

TRY THIS: Use OneDrive to Store and Share Your Files in the Cloud 125

MAKE THIS: TOOL: App Inventor 2 or Thinkable 126

Part 2: Using the Web Effectively 127

Learning Outcome 3.2 You will be able to describe the tools and techniques required to navigate and search the web.

Accessing and Moving Around the Web 127

Web Browsers 127

Objective 3.7 Explain what web browsers are, and describe their common features.

URLs, Protocols, and Domain Names 129

Objective 3.8 Explain what a URL is and discuss its main parts.

Navigating the Web 130

Objective 3.9 Describe tools used to navigate the web.

BITS&BYTES: Maintain Your Privacy While Searching the Web 131

Searching the Web Effectively 132

Using Search Engines 132

Objective 3.10 Describe the types of tools used to search the web, and summarize strategies used to refine search results.

BITS&BYTES: Digital Assistants and Predictive Search	133
SOUND BYTE: Finding Information on the Web	135
Evaluating Websites	135
Objective 3.11 Describe how to evaluate a website to ensure it is appropriate to use for research purposes.	
HELPDESK: Evaluating Websites	135
TRENDS IN IT: Linked Data and the Semantic Web	136
BITS&BYTES: Why Isn't Wikipedia Good to Use as a Source for a Research Paper?	137
Using the Web Ethically	137
Digital Activism	137
Objective 3.12 Demonstrate an understanding of the ethical issues regarding digital activism.	
Geolocation	138
Objective 3.13 Demonstrate an understanding of the ethical issues regarding location tracking applications and devices.	
BITS&BYTES: Human-Implanted Data Chips: Protection or Invasive Nightmare?	139
ETHICS IN IT: Cyber Harassment	140
SOLVE THIS: Create a Report: Conducting Research on the Web	147

Chapter 4

Application Software: Programs That Let You Work and Play 148

Part 1: Accessing, Using, and Managing Software 150

Learning Outcome 4.1 You will be able to explain the ways to access and use software and describe how to best manage your software.

Software Basics	150
Application vs. System Software	150
Objective 4.1 Compare application software and system software.	
Distributing Software	150
Objective 4.2 Explain the differences between commercial software and open source software and describe models for software distribution.	
BITS&BYTES: Finding Alternative Software	151
Managing Your Software	151
Purchasing Software	151
Objective 4.3 Explain the different options for purchasing software.	
TRENDS IN IT: Mobile Payment Apps: The Power of M-Commerce	152
HELPDESK: Buying and Installing Software	153
Installing and Uninstalling Software	153
Objective 4.4 Describe how to install and uninstall software.	
BITS&BYTES: Ridding Your Computer of "Bloat"	153
Upgrading Software	154
Objective 4.5 Explain the considerations around the decision to upgrade your software.	
DIG DEEPER: How Number Systems Work	154
Software Licenses	155
Objective 4.6 Explain how software licenses function.	
SOUND BYTE: Where Does Binary Show Up?	155
ETHICS IN IT: Can I Install Software That I Don't Own?	157
TRY THIS: Citing Website Sources	159
MAKE THIS: TOOL: App Inventor 2 or Thunkable	160

Part 2: Application Software 161

Learning Outcome 4.2 Describe the different types of application software used for productivity and multimedia.

Productivity and Business Software	161
Productivity Software	161
Objective 4.7 Categorize the types of application software used to enhance productivity and describe their uses and features.	

BITS&BYTES: Productivity Software Tips and Tricks	161
BITS&BYTES: How to Open Unknown File Types	162
BITS&BYTES: Going Beyond PowerPoint	166
SOUND BYTE: Programming for End Users	168
Business Software	170
Objective 4.8 Summarize the types of software that large and small businesses use.	
BITS&BYTES: Need to Work as a Team? Try These Collaboration Tools	172
Multimedia and Educational Software	172
Digital Multimedia Software	172
Objective 4.9 Describe the uses and features of digital multimedia software.	
Digital Audio Software	174
Objective 4.10 Describe the uses and features of digital audio software.	
HELPDESK: Choosing Software	175
App Creation Software	175
Objective 4.11 Describe the features of app creation software.	
BITS&BYTES: Mirror, Mirror	177
Educational and Reference Software	177
Objective 4.12 Categorize educational and reference software and explain their features.	
SOLVE THIS: Analyzing Benchmark Data	185

Chapter 5

System Software: The Operating System, Utility Programs, and File Management 186

Part 1: Understanding System Software 188

Learning Outcome 5.1 You will be able to explain the types and functions of operating systems and explain the steps in the boot process.

Operating System Fundamentals	188
Operating System Basics	188
Objective 5.1 Discuss the functions of the operating system.	
Operating Systems for Personal Use	188
Objective 5.2 Explain the most popular operating systems for personal use.	
BITS&BYTES: Quick Assist	190
BITS&BYTES: Operating Systems for the Smart Home	190
Operating Systems for Machinery, Networks, and Business	191
Objective 5.3 Explain the different kinds of operating systems for machines, networks, and business.	
ETHICS IN IT: The Great Debate: Is macOS Safer Than Windows?	192
What the Operating System Does	193
The User Interface	194
Objective 5.4 Explain how the operating system provides a means for users to interact with the computer.	
Hardware Coordination	194
Objective 5.5 Explain how the operating system helps manage hardware such as the processor, memory, storage, and peripheral devices.	
SOUND BYTE: Using Windows Task Manager to Evaluate System Performance	194
Software Application Coordination	196
Objective 5.6 Explain how the operating system interacts with application software.	
TRENDS IN IT: Are Personal Computers Becoming More Human?	197
Starting Your Computer	198
The Boot Process	198
Objective 5.7 Discuss the process the operating system uses to start up the computer and how errors in the boot process are handled.	

HELPDESK: Starting the Computer: The Boot Process	200
TRY THIS: Using Virtual Desktops in Windows 10	202
MAKE THIS: TOOL: App Inventor 2 or Thunkable	203
Part 2: Using System Software	204
Learning Outcome 5.2 You will be able to describe how to use system software, including the user interface, file management capabilities, and utility programs.	
The Windows Interface	204
Using Windows 10	204
Objective 5.8 Describe the main features of the Windows interface.	
BITS&BYTES: Snip and Sketch	205
File Management	207
Organizing Your Files	207
Objective 5.9 Summarize how the operating system helps keep your computer organized and manages files and folders.	
BITS&BYTES: Save Files in the Cloud	209
BITS&BYTES: Using Storage Sense	210
HELPDESK: Organizing Your Computer: File Management	211
Utility Programs	213
Windows Administrative Utilities	214
Objective 5.10 Outline the tools used to enhance system productivity, back up files, and provide accessibility.	
DIG DEEPER: How Disk Defragmenting Utilities Work	216
SOUND BYTE: Hard Disk Anatomy	216
SOLVE THIS: Operating Systems: Analyzing Market Share	225

Chapter 6

Understanding and Assessing Hardware: Evaluating Your System 226

Part 1: Evaluating Key Subsystems 228

Learning Outcome 6.1 You will be able to evaluate your computer system's hardware functioning, including the CPU and memory subsystems.

Your Ideal Computing Device	228
Moore's Law	228
Objective 6.1 Describe the changes in CPU performance over the past several decades.	
Selecting a Computing Device	229
Objective 6.2 Compare and contrast a variety of computing devices.	
Evaluating the CPU Subsystem	231
How the CPU Works	231
Objective 6.3 Describe how a CPU is designed and how it operates.	
BITS&BYTES: Liquid Cooling	235
Measuring CPU Performance	235
Objective 6.4 Describe tools used to measure and evaluate CPU performance.	
DIG DEEPER: The Machine Cycle	237
Evaluating the Memory Subsystem	238
Random Access Memory	238
Objective 6.5 Discuss how RAM is used in a computer system.	
Adding RAM	240
Objective 6.6 Evaluate whether adding RAM to a system is desirable.	
HELPDESK: Evaluating Your CPU and RAM	240
SOUND BYTE: Installing RAM	241
TRY THIS: Measure Your System Performance	243
MAKE THIS: TOOL: App Inventor 2 or Thunkable	244

Part 2: Evaluating Other Subsystems and Making a Decision 245

Learning Outcome 6.2 You will be able to evaluate your computer system's storage subsystem, media subsystem, and reliability and decide whether to purchase a new system or upgrade an existing one.

Evaluating the Storage Subsystem	245
Types of Storage Drives	245
Objective 6.7 <i>Classify and describe the major types of nonvolatile storage drives.</i>	
SOUND BYTE: Installing an SSD Drive	246
DIG DEEPER: How Storage Devices Work	247
Storage Needs	248
Objective 6.8 <i>Evaluate the amount and type of storage needed for a system.</i>	
BITS&BYTES: How Hot Is My GPU?	250
Evaluating the Media Subsystems	251
Video Cards	251
Objective 6.9 <i>Describe the features of video cards.</i>	
BITS&BYTES: Make Your Tablet a Second Monitor	253
TRENDS IN IT: USB 3.2 C Ports: One Port to Rule Them All!	254
Sound Cards	255
Objective 6.10 <i>Describe the features of sound cards.</i>	
HELPDESK: Evaluating Computer System Components	255
Evaluating System Reliability and Moving On	257
Maintaining System Reliability	257
Objective 6.11 <i>Describe steps you can take to optimize your system's reliability.</i>	
Getting Rid of Your Old Computer	259
Objective 6.12 <i>Discuss how to recycle, donate, or dispose of an older computer.</i>	
ETHICS IN IT: Free Hardware for All	260
SOLVE THIS: Laptop Alternatives	267

Chapter 7

Networking: Connecting Computing Devices 268

Part 1: How Networks Function 270

Learning Outcome 7.1 You will be able to explain the basics of networking, including the components needed to create a network, and describe the different ways a network can connect to the Internet.

Networking Fundamentals	270
Understanding Networks	270
Objective 7.1 <i>Describe computer networks and their pros and cons.</i>	
HELPDESK: Understanding Networking	271
Network Architectures	272
Network Designs	272
Objective 7.2 <i>Explain the different ways networks are defined.</i>	
DIG DEEPER: P2P File Sharing	274
Network Components	275
Transmission Media	275
Objective 7.3 <i>Describe the types of transmission media used in networks.</i>	
SOUND BYTE: Installing a Home Computer Network	275
Basic Network Hardware	277
Objective 7.4 <i>Describe the basic hardware devices necessary for networks.</i>	
Network Software	278
Objective 7.5 <i>Describe the type of software necessary for networks.</i>	
TRENDS IN IT: How Smart Is Your Home?	279

Connecting to the Internet	279
Broadband Internet Connections	279
Objective 7.6 Summarize the broadband options available to access the Internet.	
BITS&BYTES: Net Neutrality	280
BITS&BYTES: Who's Not on Broadband?	281
Wireless Internet Access	281
Objective 7.7 Summarize how to access the Internet wirelessly.	
TRY THIS: Testing Your Internet Connection Speed	283
MAKE THIS: TOOL: Ping and Telnet	284

Part 2: Your Home Network **285**

Learning Outcome 7.2 You will be able to describe what is necessary to install and configure a home network and how to manage and secure a wireless network.

Installing and Configuring Home Networks	285
Planning Your Home Network	285
Objective 7.8 Explain what should be considered before creating a home network.	
BITS&BYTES: Power Your Devices—Wirelessly	286
Connecting Devices to a Network	286
Objective 7.9 Describe how to set up a home network.	
BITS&BYTES: Mesh Networks: An Emerging Alternative	288
BITS&BYTES: Analyzing Network Problems	290
Managing and Securing Wireless Networks	290
Troubleshooting Wireless Network Problems	290
Objective 7.10 Describe the potential problems with wireless networks and the means to avoid them.	
Securing Wireless Networks	290
Objective 7.11 Describe how to secure wireless home networks.	
SOUND BYTE: Securing Wireless Networks	292
HELPDESK: Managing and Securing Your Wireless Network	292
SOLVE THIS: Home Networking Guide	299

Chapter 8

Managing Your Digital Lifestyle: Challenges and Ethics 300

Part 1: The Impact of Digital Information **302**

Learning Outcome 8.1 You will be able to describe the nature of digital signals; how digital technology is used to produce and distribute digital texts, music, and video; and the challenges in managing a digital lifestyle.

Digital Basics	302
Digital Convergence and the Internet of Things	302
Objective 8.1 Describe how digital convergence and the Internet of Things have evolved.	
Digital versus Analog	304
Objective 8.2 Explain the differences between digital and analog signals.	
Digital Publishing	306
e-Readers	306
Objective 8.3 Describe the different types of e-readers.	
Using e-Texts	307
Objective 8.4 Explain how to purchase, borrow, and publish e-texts.	
HELPDESK: Managing Digital Media	307
Digital Music	308
Creating and Storing Digital Music	308
Objective 8.5 Describe how digital music is created and stored.	
Distributing Digital Music	310
Objective 8.6 Summarize how to listen to and publish digital music.	

Digital Media	311
Digital Photography	311
Objective 8.7 <i>Explain how best to create, print, and share digital photos.</i>	
SOUND BYTE: Enhancing Photos with Image-Editing Software	312
Digital Video	313
Objective 8.8 <i>Describe how to create, edit, and distribute digital video.</i>	
TRENDS IN IT: Digital Asset Managers Needed!	316
Managing Your Digital Lifestyle	316
Digital Challenges and Dilemmas	317
Objective 8.9 <i>Discuss the challenges in managing an active digital lifestyle.</i>	
DIG DEEPER: Deep Web versus Dark Web: Are There Places You Shouldn't Go?	318
BITS&BYTES: The Rise of Wearable Technology	319
BITS&BYTES: Goodbye Net Neutrality. . Hello Bandwidth Throttling	321
TRY THIS: Creating and Publishing a Movie	323
MAKE THIS: TOOL: App Inventor 2 or Thunkable	324
Part 2: Ethical Issues of Living in the Digital Age	325
Learning Outcome 8.2 You will be able to describe how to respect digital property and use it in ways that maintain your digital reputation.	
Protection of Digital Property	325
Intellectual Property	325
Objective 8.10 <i>Describe the various types of intellectual property.</i>	
Copyright Basics	326
Objective 8.11 <i>Explain how copyright is obtained and the rights granted to the owners.</i>	
HELPDESK: Understanding Intellectual Property and Copyright	328
Copyright Infringement	329
Objective 8.12 <i>Explain copyright infringement, summarize the potential consequences, and describe situations in which you can legally use copyrighted material.</i>	
BITS&BYTES: Software Piracy: It's More Than Just Downloading and Copying	331
BITS&BYTES: Your Tax Dollars at Work: Free Media without Permission!	333
Living Ethically in the Digital Era	334
Plagiarism	334
Objective 8.13 <i>Explain plagiarism and strategies for avoiding it.</i>	
Hoaxes and Digital Manipulation	336
Objective 8.14 <i>Describe hoaxes and digital manipulation.</i>	
SOUND BYTE: Plagiarism and Intellectual Property	336
Protecting Your Online Reputation	339
Objective 8.15 <i>Describe what comprises your online reputation and how to protect it.</i>	
BITS&BYTES: Celebrity Photographic Rights	341
ETHICS IN IT: Acceptable Use Policies: What You Can and Can't Do	342
SOLVE THIS: Intellectual Property and Copyright Basics	349

Chapter 9

Securing Your System: Protecting Your Digital Data and Devices 350

Part 1: Threats to Your Digital Assets 352

Learning Outcome 9.1 **You will be able to describe hackers, viruses, and other online annoyances and the threats they pose to your digital security.**

Identity Theft and Hackers 352

 Identity Theft

Objective 9.1 *Describe how identity theft is committed and the types of scams identity thieves perpetrate.*

Hacking	353
Objective 9.2 Describe the different types of hackers and the tools they use.	
BITS&BYTES: Next Generation White Hat Hackers	354
Computer Viruses	357
Virus Basics	357
Objective 9.3 Explain what a computer virus is, why it is a threat to your security, how a computing device catches a virus, and the symptoms it may display.	
SOUND BYTE: Protecting Your Computer	358
Types of Viruses	359
Objective 9.4 List the different categories of computer viruses, and describe their behaviors.	
Online Annoyances and Social Engineering	360
Online Annoyances	361
Objective 9.5 Explain what malware, spam, and cookies are and how they impact your security.	
Social Engineering	363
Objective 9.6 Describe social engineering techniques, and explain strategies to avoid falling prey to them.	
BITS&BYTES: I Received a Data Breach Letter . . . Now What?	364
ETHICS IN IT: You're Being Watched . . . But Are You Aware You're Being Watched?	366
HELPDESK: Threats to Your Digital Life	366
TRENDS IN IT: Spear Phishing: The Bane of Data Breaches	367
TRY THIS: Testing Your Network Security	369
MAKE THIS: App Inventor 2 or Thinkable	370
Part 2: Protecting Your Digital Property	371
Learning Outcome 9.2 Describe various ways to protect your digital property and data from theft and corruption.	
Restricting Access to Your Digital Assets	371
Firewalls	371
Objective 9.7 Explain what a firewall is and how a firewall protects your computer from hackers.	
Preventing Virus Infections	373
Objective 9.8 Explain how to protect your computer from virus infection.	
HELPDESK: Understanding Firewalls	373
Authentication: Passwords and Biometrics	376
Objective 9.9 Describe how passwords and biometric characteristics can be used for user authentication.	
BITS&BYTES: CAPTCHA: Keeping Websites Safe from Bots	376
Anonymous Web Surfing: Hiding from Prying Eyes	378
Objective 9.10 Describe ways to surf the Web anonymously.	
BITS&BYTES: Multi-Factor Authentication: Don't Rely Solely on Passwords!	380
Keeping Your Data Safe	380
Protecting Your Personal Information	380
Objective 9.11 Describe the types of information you should never share online.	
SOUND BYTE: Managing Computer Security with Windows Tools	380
Backing Up Your Data	381
Objective 9.12 List the various types of backups you can perform on your computing devices, and explain the various places you can store backup files.	
Protecting Your Physical Computing Assets	385
Environmental Factors and Power Surges	385
Objective 9.13 Explain the negative effects environment and power surges can have on computing devices.	
Preventing and Handling Theft	385
Objective 9.14 Describe the major concerns when a device is stolen and strategies for solving the problems.	
DIG DEEPER: Computer Forensics: How It Works	387
SOLVE THIS: Computer Security	395

Chapter 10

Behind the Scenes: Software Programming 396

Part 1: Understanding Programming 398

Learning Outcome 10.1 You will be able to describe the life cycle of a software project and identify the stages in the program development life cycle.

Life Cycle of an Information System 398

The Importance of Programming 398

Objective 10.1 Describe the importance of programming to both software developers and users.

System Development Life Cycle 398

Objective 10.2 Summarize the stages of the system development life cycle.

BITS&BYTES: The Agile Scrum 400

Life Cycle of a Program 400

The Program Development Life Cycle 400

Objective 10.3 Define programming and list the steps in the program development life cycle.

The Problem Statement 401

Objective 10.4 Describe how programmers construct a complete problem statement from a description of a task.

SOUND BYTE: Using the Arduino Microcontroller..... 401

HELPDESK: Understanding Software Programming..... 402

Algorithm Development 403

Objective 10.5 Explain how programmers use flow control and design methodologies when developing algorithms.

BITS&BYTES: Coding with a Purpose 406

DIG DEEPER: The Building Blocks of Programming Languages: Syntax, Keywords,

Data Types, and Operators 408

Coding 409

Objective 10.6 Discuss the categories of programming languages and the roles of the compiler and the integrated development environment in coding.

Debugging 415

Objective 10.7 Identify the role of debugging in program development.

BITS&BYTES: Many Languages on Display 416

Testing and Documentation 416

Objective 10.8 Explain the importance of testing and documentation in program development.

TRY THIS: Programming with Corona 418

MAKE THIS: TOOL: App Inventor 2 or Thunkable 419

Part 2: Programming Languages 420

Learning Outcome 10.2 You will understand the factors programmers consider when selecting an appropriate programming language for a specific problem and will be familiar with some modern programming languages.

Many Programming Languages 420

Need for Diverse Languages 420

Objective 10.9 Discuss the driving factors behind the popularity of various programming languages.

SOUND BYTE: Programming with the Processing Language..... 420

Selecting the Right Language 421

Objective 10.10 Summarize the considerations in identifying an appropriate programming language for a specific setting.

BITS&BYTES: Learn to Code for Free at freeCodeCamp 421

ETHICS IN IT: When Software Runs Awry 422

Exploring Programming Languages 423

Tour of Modern Languages 423

Objective 10.11 Compare and contrast modern programming languages.

BITS&BYTES: Your Software Portfolio 427

TRENDS IN IT: Emerging Technologies: Unite All Your Video Game Design Tools 431

Future of Programming Languages	431
Objective 10.12 State key principles in the development of future programming languages.	
HELPDESK: A Variety of Programming Languages	432
SOLVE THIS: Time Sheets	439

Chapter 11

Behind the Scenes: Databases and Information Systems 440

Part 1: Database Fundamentals 442

Learning Outcome 11.1 You will be able to explain the basics of databases, including the most common types of databases and the functions and components of relational databases in particular.

The Need for Databases 442

Database Basics 442

Objective 11.1 Explain what a database is and why databases are useful.

Database Types 444

Flat Databases 444

Objective 11.2 Describe features of flat databases.

Relational Databases 446

Objective 11.3 Describe features of relational databases.

BITS&BYTES: Normal Forms 447

Object-Oriented Databases 447

Objective 11.4 Describe features of object-oriented databases.

Multidimensional Databases 447

Objective 11.5 Describe features of multidimensional databases.

HELPDESK: Using Databases..... 447

NoSQL Databases 448

Objective 11.6 Describe how Web 2.0 data is managed in a database.

Using Databases 449

Relational Database Components and Functions 449

Objective 11.7 Describe how relational databases organize and define data.

SOUND BYTE: Creating and Querying an Access Database 452

BITS&BYTES: Music Streaming Services Use Databases 453

Inputting and Managing Data 453

Objective 11.8 Describe how data is inputted and managed in a database.

DIG DEEPER: Structured Query Language (SQL) 458

BITS&BYTES: Data Dashboards: Useful Visualization Tools 460

TRY THIS: Using Excel's Database Functions 462

MAKE THIS: TOOL: App Inventor 2 or Thunkable 463

Part 2: How Businesses Use Databases 464

Learning Outcome 11.2 You will be able to explain how businesses use data warehouses, data marts, and data mining to manage data and how business information systems and business intelligence are used to make business decisions.

Data Warehousing and Storage 464

Data Warehouses and Data Marts 464

Objective 11.9 Explain what data warehouses and data marts are and how they are used.

HELPDESK: How Businesses Use Databases..... 464

BITS&BYTES: Data Warehouses Are Going to the Cloud 465

Data Mining 466

Objective 11.10 Describe data mining and how it works.

BITS&BYTES: Hadoop: How Big Data Is Being Managed 467

ETHICS IN IT: Data, Data Everywhere—But Is It Protected? 469

Using Databases to Make Business Decisions	469
Business Information Systems	469
Objective 11.11 <i>Describe the main types of business information systems and how they are used by business managers.</i>	
SOUND BYTE: Analyzing Data with Microsoft Power BI Suite	474
BITS&BYTES: Virtual Agents: Expert Systems Replace People on the Web	474
TRENDS IN IT: Mobile Business Intelligence	475
SOLVE THIS: College Database	483

Chapter 12

Behind the Scenes: Networking and Security in the Business World 484

Part 1: Client/Server Networks and Topologies 486

Learning Outcome 12.1 You will be able to describe common types of client/server networks, servers found on them, and network topologies used to construct them.

Client/Server Network Basics	486
Networking Advantages	486
Objective 12.1 <i>List the advantages for businesses of installing a network.</i>	
Comparing Client/Server and Peer-to-Peer Networks	487
Objective 12.2 <i>Explain the differences between a client/server network and a peer-to-peer network.</i>	
Types of Client/Server Networks	488
Objective 12.3 <i>Describe the common types of client/server networks as well as other networks businesses use.</i>	
BITS&BYTES: Make Your Browser Protect You!	491
Servers and Network Topologies	492
Servers	492
Objective 12.4 <i>List the common types of servers found on client/server networks.</i>	
HELPDESK: Using Servers	493
TRENDS IN IT: Virtualization: Making Servers Work Harder	494
Network Topologies	495
Objective 12.5 <i>Describe the common types of network topologies and the advantages and disadvantages of each one.</i>	
SOUND BYTE: Network Topology and Navigation Devices	497
TRY THIS: Sharing Printers on a Network Using Windows	502
MAKE THIS: TOOL: App Inventor 2 or Thunkable	503

Part 2: Setting Up Business Networks 504

Learning Outcome 12.2 You will be able to describe transmission media, network operating system software, and network navigation devices and explain major threats to network security and how to mitigate them.

Transmission Media	504
Wired and Wireless Transmission Media	504
Objective 12.6 <i>Describe the types of wired and wireless transmission media used in networks.</i>	
BITS&BYTES: Guidance on Green Computing	506
Network Adapters and Navigation Devices	506
Network Adapters	506
Objective 12.7 <i>Describe how network adapters help data move around a network.</i>	
MAC Addresses	508
Objective 12.8 <i>Define MAC addresses, and explain how they are used to move data around a network.</i>	
Switches, Bridges, and Routers	509
Objective 12.9 <i>List the various network navigation devices, and explain how they help route data through networks.</i>	
HELPDESK: Transmission Media and Network Adapters	510
Network Operating Systems and Network Security	510
Network Operating Systems	511
Objective 12.10 <i>Explain why network operating systems are necessary for networks to function.</i>	
BITS&BYTES: Extending Smart Homes: Smart Yards Coming Soon!	511

Client/Server Network Security	512
Objective 12.11 <i>List major security threats to networks, and explain how network administrators mitigate these threats.</i>	
DIG DEEPER: The OSI Model: Defining Protocol Standards	513
SOUND BYTE: A Day in the Life of a Network Technician	514
ETHICS IN IT: How Should Companies Handle Data Breaches?	517
BITS&BYTES: Logging in? Try Finger Vein Recognition	518
SOLVE THIS: Cyber-Security Flyer and Mail Merge	525

Chapter 13

Behind the Scenes: How the Internet Works 526

Part 1: Inner Workings of the Internet 528

Learning Outcome 13.1 You will be able to explain how the Internet is managed and the details of how data is transmitted across the Internet.

Internet Management and Networking 528

Management 528

Objective 13.1 *Describe the management of the Internet.*

Networking Components 529

Objective 13.2 *Explain how the Internet's networking components interact.*

Data Transmission 530

Objective 13.3 *List and describe the Internet protocols used for data transmission.*

BITS&BYTES: A Free Cloud-Based Server for You 530

Internet Identity 533

IP Addresses 533

Objective 13.4 *Explain how each device connected to the Internet is assigned a unique address.*

HELPDESK: Understanding IP Addresses, Domain Names, and Protocols 533

BITS&BYTES: What's Your IP Address? 534

BITS&BYTES: Amazing Applications of IoT 534

SOUND BYTE: Creating Web Pages with Squarespace 535

DIG DEEPER: Connection-Oriented Versus Connectionless Protocols 536

Domain Names 537

Objective 13.5 *Discuss how a numeric IP address is changed into a readable name.*

BITS&BYTES: Scale Up for Success 538

TRY THIS: Ping Me 541

MAKE THIS: TOOL App Inventor 2 or Thunkable 542

Part 2: Coding and Communicating on the Internet 543

Learning Outcome 13.2 You will be able to describe the web technologies used to develop web applications.

Web Technologies 543

Web Development 543

Objective 13.6 *Compare and contrast a variety of web development languages.*

BITS&BYTES: CodePen: An Editing Community for Web Designers 544

Application Architecture 546

Objective 13.7 *Compare and contrast server-side and client-side application software.*

SOUND BYTE: Client-Side Web Page Development 547

BITS&BYTES: Repl It 549

Communications over the Internet 549

Types of Internet Communication 549

Objective 13.8 *Discuss the mechanisms for communicating via e-mail and instant messaging.*

BITS&BYTES: AI and Your Inbox 551

Encryption 552

Objective 13.9 *Explain how data encryption improves security.*

BITS&BYTES: Numbers: We Wouldn't Have Encryption Without Them!	553
ETHICS IN IT: Do We Really Want Strong Encryption?	554
HELPDESK: Keeping E-Mail Secure	554
TRENDS IN IT: Cognitive Computing	555
SOLVE THIS: Creating an HTML Document	563

Appendix A

The History of the Personal Computer	564
--	-----

Appendix B

Careers in IT	576
Glossary	590
Index	608

Learn Technology by Using *Technology in Action* 16e

Technology in Action continues to be a bestseller because it delivers an engaging approach to teaching the topics and skills students need to be digitally literate. Using practical content, hands-on projects, and interactive simulation activities, students are engaged in learning.

Today's students are more tech savvy than ever and they expect what they are learning in the classroom to be as current as their Twitter feeds and social media updates. Traditional print textbooks cannot keep up effectively, but e-texts and digital technology can deliver a more up-to-date experience. So, for those customers using the *Technology in Action* etext, the 16th edition has been thoroughly reviewed and updated to ensure coverage of the latest in technology. New topics such as foldable phones, CPUs that fight back against malware, and bandwidth throttling (by ISPs) have been included and new Dig Deepers like XR Extended Reality are included. When students read the etext, they will be learning about truly current and relevant topics.

The updates were made with the instructor in mind so that there is no real work for you to do – just know the content is timely and check out the transition guide that provides the specifics on what has been updated or changed. The learning objectives and test questions related to them have not been changed so that changes to your existing syllabi and quizzes should not be required. The new features of the 16th edition are all still there, including the web-based survey activities that encourage students to engage with their peers and develop critical thinking skills through the *What Do You Think?* questions. These activities along with the Tech in the News updates at the beginning of each chapter, videos, interactive Helpdesk activities, Sound Byte lessons, IT simulations, and a variety of hands-on projects all help students learn the concepts and skills they need to be digitally literate in today's workplace. And, if they are using MyLab IT, they can earn the *Digital Competency* badge to demonstrate their skills to potential employers.

Hallmarks

- Engaging **question-and-answer writing style** that approaches topics as students do.
- **Ethics coverage** throughout, including in end-of-chapter activities, Point/Counterpoint ethical debate content found in relevant chapters, and a Sound Byte lesson on how to discuss and debate ethical issues.
- **Hands-on learning** with projects throughout each chapter:
 - **Try This** projects allow students to practice and demonstrate their proficiency with important topics. Each project is accompanied by a how-to video.
 - **Solve This** projects put the concepts students are learning into action through real-world problem solving using Microsoft Office programs. Grader project versions of most of these projects are in MyLab IT.
 - **Make This** projects provide activities where students build programs that run on their mobile devices. Twelve of the chapters have activities that build fully functional mobile apps, compatible with either Android or iOS. Each project includes instructions and a how-to video.
- **Interactive activities** engage students in active learning and *demonstration* of understanding:
 - **Helpdesk** interactive activities provide a review of chapter objectives by having students play the role of a helpdesk staffer assisting customers via a live chat using a decision-based simulation with a quiz.
- **Sound Byte** audio lessons provide coverage of additional topics related to the chapter, including a brief quiz.
- **IT Simulations** provide an in-depth chapter scenario that students work through in an active learning environment and complete with a brief quiz to demonstrate understanding. They have been redesigned for a more engaging and easier-to-use learning experience that helps students actively demonstrate understanding. They now include a “presentation mode” so instructors can walk through the simulation in class or with students.
- **Review and Quizzes**
 - **Check Your Understanding Quizzes** provide a self-check covering objectives in each part of the chapter so that students can see how well they are learning the content.
 - The **Chapter Quiz** provides a way for students to test that they have learned the material from the entire chapter.
 - **New “Chew on This”** critical thinking questions require that students demonstrate their understanding through written answers that are manually graded.
 - **Testbank Exams** provide customizable prebuilt, autograded, objective-based questions covering the chapter objectives.

- **Videos**
 - **Chapter Overview Videos** provide an objective-based review of what students should have learned.
 - **Try This** and **Make This** project videos
- **Helpful Resources**
 - **PowerPoint and Audio Presentations** can be used in class for lecture or assigned to students,

particularly online students, for instruction and review.

- **Instructor Chapter Guides** provide teaching tips; homework and assessment suggestions; a brief overview of each chapter's *Try This*, *Make This*, and *Solve This* exercises; as well as select Sound Byte talking points and ethics debate starters.

What's New?

- **What Do You Think?** discussion topics begin each chapter with surveys that students complete. They then respond to follow-up questions related to the topic at the end of the chapter to encourage critical thinking.
- **Chew on This** critical thinking questions at the end of each chapter part, encourage students to think critically about the impact of technology on society.
- **Technology in the News** (formerly *TechBytes Weekly*) lets you keep your class current with weekly technology news.
- **Chapter 8** has been expanded to discuss the challenges students face in managing an active digital lifestyle such as the Dark Web, keeping data private, and using cryptocurrency.
- **Images and quizzes** have been updated throughout.
- A new **Try This project in Chapter 1**—*What Does Facebook Know About You?*—lets students explore the detailed information collected about them by the social media platform.

The *Bits&Bytes: Is Dial-Up Still an Option?* has been updated.

The *Bits&Bytes: 5G Is Coming—Is It Worth the Wait?* has been deleted and content has been added to the text.

Ethics in IT: Ethical Challenges of the Internet of Things has moved to Chapter 8.

A new *Bits&Bytes: Power Your Devices Wirelessly* has been added.

Revisions to setting up a Windows home network have been made to remove concept of homegroups.

The *Bits&Bytes: The Rise of Wearable Technology* has moved to Chapter 8.

A new *Ethics in IT: Privacy Challenges of Delivering Free Wi-Fi* has been added.

Chapter 8

Ethics in IT: Ethical Challenges of the Internet of Things has been relocated from Chapter 7.

A new objective, "Discuss the challenges in managing an active digital lifestyle," has been added to the chapter.

A new *Dig Deeper, Deep Web versus Dark Web: Are There Places You Shouldn't Go?*, has been added to the chapter.

Bits&Bytes: The Rise of Wearable Technology has been relocated from Chapter 7.

Chapter 9

A *Bits&Bytes* addressing the role of social media and computer security in maintaining democratic elections has been added.

Extended treatment of password managers and biometric options for access control has been added.

Chapter 10

New coverage of programming technologies like Swift and JSON.

Chapter 11

The concept of flat databases has replaced discussion of lists.

New content of NoSQL databases has been added.

The content of data staging has been updated.

A new *Bits&Bytes: The Normal Forms* has been added.

Summary of Chapter Updates

All chapter Learning Outcomes and Learning Objectives have been revised as needed and throughout the text, figures and photos have been updated with new images, current topics, and state-of-the art technology coverage.

Chapter 1

A new *Try This* exercise leading students through the steps to examine the data stored about them by social media platforms has been added.

The section on technology and careers has been updated with current trends and an emphasis on the impact of artificial intelligence.

Chapter 5

Discussions on additional mobile operating systems like watchOS and tvOS have been added.

Coverage of the latest smarthome devices and open-source solutions has been added.

Chapter 7

The *Bits&Bytes: Net Neutrality* has been updated.

Chapter 12

A new *Try This: Sharing Printers on a Network Using Windows* has been added.

Chapter 13

Coverage of web security topics like email encryption and biometrics has been updated.

The most current coverage of cognitive computing has been added.

More student-focused introduction to web frameworks and modern web technologies has been added.

The Program

To maximize student results, we recommend using *Technology in Action* with **MyLab IT**, the teaching and learning platform that empowers you to reach every student. By combining trusted author content with digital tools and a flexible platform, MyLab IT personalizes the learning experience and will help your students learn and retain key course concepts while developing skills that future employers seek.

With MyLab IT for *Technology in Action*, students have access to all of the instruction, practice, review, and assessment resources in one place. There are two ways you can set up your course:

1. You can choose to use the new *sequential learning modules* that allow you to create activities in the order you want students to complete them, providing a consistent, measurable learning experience from chapter to chapter.
2. You can take a second approach for an interactive learning experience, where students use the etext to read and learn actively with Helpdesk activities, Sound Bytes, IT Simulations, *What do You Think?* surveys and critical thinking questions, videos, and more. You assign the etext chapter, students engage in learning and practice, and go back to their assignments to take the chapter quizzes.

Solving Teaching and Learning Challenges

Technology in Action, 16e provides a hands-on approach to learning computer concepts in which students learn a little and then apply what they are learning in a project or simulation or watch a video to dive deeper. And with the new *What do you think?* surveys at the beginning of each chapter, the follow-up question at the end of the chapter related to the survey results, as well as new *Chew on This* critical thinking questions at the end of each chapter part, students are encouraged to think critically about the impact of technology on society.

The optimal way to experience *Technology in Action* is with MyLab IT. All of the instruction, practice, review, and assessment resources are in one place, allowing you to arrange your course from an instructional perspective that gives students a consistent, measurable learning experience from chapter to chapter.

Developing Employability Skills

Digital literacy is a top skill required in today's job market! Developing these skills involves conceptual as well as hands-on learning. With *Technology in Action*, students get both—they learn the fundamentals of computers and have opportunities to apply what they are learning in real-world projects and simulations. Using MyLab IT and *Technology in Action*, students can learn, practice, and demonstrate their digital literacy.

- **High-Demand Office Skills** are evaluated in the auto-graded *Solve This* projects in each chapter.
- **Essential Digital Literacy Skills** are taught and practiced throughout the book in *Try This*, *Solve This*, and *Make This* projects.

Employability Skills Matrix (ESM)

	Ethics Projects	Try This Projects	Solve This Projects	Make This Projects	What do you think?	Interactives: Helpdesks, Sound Bytes, IT Sims	Team Time Projects	Badge
Critical Thinking	x		x	x	x		X	
Communication	x				x	x	X	
Collaboration	x				x	x	X	
Knowledge Application and Analysis	x	X	x	x	x	x	X	
Social Responsibility	x	X			x			

Applied Learning Opportunities Throughout

Using MyLab IT with *Technology in Action* provides students with a variety of ways to get instruction, practice, review, and assessment.

Technology in the News

Formerly *TechBytes Weekly*, these weekly currency updates deliver the latest technology news stories to you to use in your classroom.

Try This Projects

These projects have students apply what they are learning in a practical project that uses skills they'll need in the workforce and everyday life. Each project includes a video to guide students through the project.

Try This
What's Inside My Computer?
Understanding what resides inside your current computer has to be one of the first steps toward computer literacy. In this exercise, you'll learn how to explore the components of your Windows computer. For step-by-step instructions, watch the Chapter 2 Try This video on MyLab IT.

Step 1 To gather information about the storage devices on your computer, click the **Explore** button on the toolbar. Then, in the navigation pane, click **THIS PC** to display information about your computer's storage devices and network locations.

Step 2 To get more information about the storage devices on your computer, click the **Explore** button on the toolbar. Then, in the navigation pane, click **THIS PC** to display information about your computer's storage devices and network locations.

Step 3 To get more information about the storage devices on your computer, click the **Explore** button on the toolbar. Then, in the navigation pane, click **THIS PC** to display information about your computer's storage devices and network locations.

Make This Projects

These hands-on activities lead students to explore mobile app development in either an Android or iOS environment.

Make This TOOL: App Inventor 2 or Thinkable
A Mobile App
Want to build your own Android app from scratch? You can, with a simple tool called **App Inventor**. To get started, have ready:

- A computer connected to a Wi-Fi network.
- The Chrome browser.
- A Google account.
- The MIT App Companion app (available in the Google Play Store).
- (Optional) An Android device connected to the same Wi-Fi network.

In this exercise, you'll explore the **App Inventor** tool and begin working with your first simple app. As you'll see, making your device work for you is as easy as drag and drop with **App Inventor**.

App Inventor is a programming platform used to create apps for Android devices. Using **App Inventor**, you can apply drag and drop components to design your app's interface and to behave.

To create iOS apps, go to Thinkable.com, a programming platform based on **App Inventor**.

For the detailed instructions for this exercise, go to MyLab.IT.

Helpdesk Activities

The Helpdesk training content, created specifically for *Technology in Action*, enables students to take on the role of a helpdesk staffer fielding questions posed by computer users so that students demonstrate their understanding in an active learning environment. Each Helpdesk ends with a quiz, ensuring students have grasped the content.

Evaluating Websites
In this Helpdesk, we will cover the following Learning Objectives:

- Describe the types of tools used to search the web, and summarize strategies used to refine search results.
- Describe how to evaluate a website to ensure it is appropriate to use for research purposes.

Click the **Continue** button to enter a simulated helpdesk chat session.

Solve This Projects

These exercises integrate and reinforce chapter concepts with Microsoft Office skills.

Solve This MyLab IT Grader
Technology Wish List
You've received a list of technology products, and your parents have told you they will help you finance your purchases by keeping the money they will need to pay them with a credit card. You'll need to create a wish list for each device that you need, enter the cost and provide a rationale for each device. Then you will determine the total cost for each device and provide a rationale for each device.

Instructions

1. Open **Excel 2016** and save as **TKA_C02_LearnForm.docx**.
2. Enter the name of each device in the **Device** column of the **TKA_C02_LearnForm** spreadsheet.
3. Enter the cost of each device in the **Cost** column of the **TKA_C02_LearnForm** spreadsheet.
4. Enter the rationale for each device in the **Rationale** column of the **TKA_C02_LearnForm** spreadsheet.
5. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
6. Change the **Worksheet Name** to **WishList**.
7. To apply the **TKA_C02_LearnForm** to the **TKA_C02_LearnForm** spreadsheet, click **TKA_C02_LearnForm**.
8. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
9. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
10. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
11. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
12. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
13. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
14. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
15. In cell **B40**, enter the formula to calculate the total cost of the devices. Don't include tax and/or shipping.
16. Save the spreadsheet and submit based on your instructor's directions.

Sound Bytes

Sound Bytes expand student mastery of complex topics through engaging lessons with a brief quiz to check understanding.

Blogs
Blogs are one of the most popular ways of sharing content on the web. With a blog, you can easily post text, photos, videos, and sound clips to a website so people can view it from anywhere they have Internet access. In this Sound Byte, we will explore how easy it is to set up a blog and how you can add content using mobile devices such as a smartphone. We will also discuss how to create a user profile and outline some useful sites to search for blogs.

1. What is a Blog?
2. How to Blog
3. Creating a User Profile
4. Mobile Blogging
5. Searching for Blogs

IT Simulations

These detailed interactive scenarios cover a core chapter topic in a hands-on environment where students can apply what they have learned and demonstrate understanding through active engagement.

Application Software
The key learning objectives for this simulation are:

- Identify the features and benefits of a business productivity software.
- Assess a computer system for software compatibility.

You have purchased a new computer that runs Windows 10 but it did not come with Microsoft Office. This means that you don't have access to programs that you need for school, such as Word, Excel, PowerPoint, and Access. With your limited budget, you also don't have the money to purchase Office right now.

For help with this activity, use the **Hint**.

Start

Instructor Teaching Resources

This program comes with the following teaching resources.

Supplements available to instructors at www.pearsonglobaleditions.com	Features of the Supplement
Accessible PowerPoint Presentation	PowerPoints meet accessibility standards for students with disabilities. Features include, but are not limited to: <ul style="list-style-type: none">• Keyboard and Screen Reader Access• Alternative Text for Images• High Color Contrast between Background and Foreground Colors
End-of-Chapter Answer Key, Check Your Understanding Answer Key, Chapter Quiz Answer Key	Answers to all end-of-chapter questions.
Image Library	Every image in the book.
Instructor Chapter Guide	<ul style="list-style-type: none">• Content Instruction• Student Preparation and Review• Active Learning Options• Chapter Assessment• End-of-Chapter Exercises• Currency Topics• Soft Skills and Team Work• Instructor Resources
<i>Make This Projects</i>	Activities where students build programs that run on their mobile devices. Each project includes instructions and a how-to video.
Objectives Mapping	Outline of the objectives in every chapter.
<i>Solve This Projects</i>	Real-world problem solving using Microsoft Office programs. Grader versions of most of these projects are in MyLab IT.
Syllabus Template	Sample syllabus for help in setting up your course.
Test Bank (Textbook, Helpdesk, Sound Bytes)	Over 1,000 multiple-choice, true/false, short-answer, and matching questions with these annotations: <ul style="list-style-type: none">• Difficulty level (1 for straight recall, 2 for some analysis, 3 for complex analysis)• Objective, which provides location in the text Provided for: <ul style="list-style-type: none">• Textbook• Helpdesk• Sound Byte
Computerized TestGen	TestGen allows instructors to: <ul style="list-style-type: none">• Customize, save, and generate classroom tests• Edit, add, or delete questions from the Test Item files• Analyze test results• Organize a database of tests and student results
Transition Guide	Detailed explanation of changes between the previous and current edition.
Web Projects	Discussion questions and additional projects that can be done on the Internet.

Letter from the Authors

Our 16th Edition—A Letter from the Authors



Why We Wrote This Book

The pace of technological change is ever increasing. In education, we have seen this impact us more than ever recently—the Maker movement, the Internet of Things, MOOCs, touch-screen mobile delivery, and Hangouts are now fixed parts of our environment.

Even the most agile of learners and educators need support in keeping up with this pace of change. Our students have easier access to more information than any generation before them. We recognize the need for them to be able to think critically and investigate the data they see. In this edition, we introduce the use of chapter-opening features called *What do you think?* that allow students to critically think about a chapter topic. Students then follow up at the end of the chapter by answering additional related critical thinking questions in a *What do you think now?* feature.

We have also responded by integrating material to help students develop skills for web application and mobile programming. We see the incredible value of these skills and their popularity with students and have included *Make This* exercises for each chapter. These exercises gently bring the concepts behind mobile app development to life. In addition, there is a *Solve This* exercise in each chapter that reinforces chapter content while also applying Microsoft Office skills. These projects help to promote students' critical-thinking and problem-solving skills, which employers value highly.

The Helpdesk and Sound Byte training modules and IT Simulations continue to provide students with an active learning environment in which they can reinforce their learning of chapter objectives. In this edition, we have put the spotlight on critical thinking. We've integrated real-time surveys on important technology topics to foster classroom discussion and analytical skills. We have also included additional material on key challenges of a digital lifestyle, such as using digital currency, avoiding the Dark Web, and protecting privacy.

We also continue to emphasize the many aspects of ethics in technology debates. Some of the Helpdesks and IT Simulations support instruction on how to conduct thoughtful and respectful discussion on complex ethical issues.

Our combined 70 years of teaching computer concepts have coincided with sweeping innovations in computing technology that have affected every facet of society. From iPads to Web 2.0, computers are more than ever a fixture of our daily lives—and the lives of our students. But although today's students have a much greater comfort level with their digital environment than previous generations, their knowledge of the machines they use every day is still limited.

Part of the student-centered focus of our book has to do with making the material truly engaging to students. From the beginning, we have written *Technology in Action* to focus on what matters most to today's student. Instead of a history lesson on the microchip, we focus on tasks students can accomplish with their computing devices and skills they can apply immediately in the workplace, in the classroom, and at home.

We strive to keep the text as current as publishing timelines allow. Because electronic media can be updated without the expense of a full edition we have reviewed all content to make sure it is the most current. The field of technology changes swiftly and the social impacts of technology seem to be changing even more quickly. We are excited that the text can be delivered to your students with the confidence that it reflects current events and technical specifications.

We also continue to include a number of multimedia components to enrich the classroom and student learning experience. The result is a learning system that sparks student interest by focusing on the material they want to learn (such as how to integrate devices into a home network) while teaching the material they need to learn (such as how networks work). The sequence of topics is carefully set up to mirror the typical student learning experience.

As they read this text, your students will progress through stages and learning outcomes of increasing difficulty:

- Thinking about how technology offers them the power to change their society and their world and examining why it's important to be computer fluent
- Understanding the basic components of computing devices
- Connecting to and exploring the Internet
- Exploring application software
- Learning about the operating system and personalizing their computer
- Evaluating and upgrading computing devices
- Understanding home networking options
- Creating digital assets and understanding how to legally distribute them
- Keeping computing devices safe from hackers
- Going behind the scenes, looking at technology in greater detail

We strive to structure the book in a way that makes navigation easy and reinforces key concepts. We continue to design the text around learning outcomes and objectives, making them a prominent part of the chapter structure. Students will see the learning outcomes and objectives in the chapter opener, throughout the text itself, as well as in the summary so they understand just what they are expected to learn.

We also continue to structure the book in a progressive manner, intentionally introducing on a basic level in the earlier chapters concepts that students traditionally have trouble with and then later expanding on those concepts in more detail when students have become more comfortable with them. Thus, the focus of the early chapters is on practical uses for the computer, with real-world examples to help the students place computing in a familiar context. For example, we introduce basic hardware components in Chapter 2, and then we go into increasingly greater detail on some hardware components in Chapter 6. The Behind the Scenes chapters venture deeper into the realm of computing through in-depth explanations of how programming, networks, the Internet, and databases work. They are specifically designed to keep more experienced students engaged and to challenge them with interesting research assignments.

In addition to extensive review, practice, and assessment content, each chapter contains several problem-solving, hands-on activities that can be carried out in the classroom or as homework:

- The *Try This* exercises lead students to explore a particular computing feature related to the chapter.
- The *Make This* exercises are hands-on activities that lead students to explore mobile app development in both the Android and iOS environments.
- The *Solve This* exercises integrate and reinforce chapter concepts with Microsoft Office skills.

Throughout the years we have also developed a comprehensive multimedia program to reinforce the material taught in the text and to support both classroom lectures and distance learning:

- New chapter-opening features called *What do you think?* allow students to critically think about a chapter topic. Students then follow up at the end of the chapter by answering additional related critical thinking questions in a *What do you think now?* feature.
- New *Chew on This* critical-thinking questions require that students demonstrate their understanding through written answers that are manually graded.
- The Helpdesk training content, created specifically for *Technology in Action*, enables students to take on the role of a helpdesk staffer fielding questions posed by computer users so that students can demonstrate their understanding in an active learning environment.
- Sound Bytes expand student mastery of complex topics through engaging lessons with a brief quiz to check understanding.

- IT Simulations are detailed, interactive scenarios covering the core chapter topic. As students work through the simulation, they apply what they have learned and demonstrate understanding in an active learning environment.
- The *What's New in Technology* (formerly *TechBytes Weekly*) is a weekly currency update that delivers the latest technology news stories to you for use in your classroom. In addition, the currency items have discussion points or activities included.

About the Authors



Alan Evans, MS, CPA

aevans@mc3.edu

Alan is currently a faculty member at Moore College of Art and Design and Montgomery County Community College, teaching a variety of computer science and business courses. He holds a BS in accounting from Rider University and an MS in Information Systems from Drexel University, and he is a certified public accountant. After a successful career in business, Alan finally realized that his true calling is education. He has been teaching at the college level since 2000. He enjoys attending technical conferences and exploring new methods of engaging students.



Kendall Martin, PhD

kmartin@mc3.edu

Kendall is a full professor of Computer Science at Montgomery County Community College with teaching experience at both the undergraduate and graduate levels at a number of institutions, including Villanova University, DeSales University, Ursinus College, and Arcadia University. Her education includes a BS in electrical engineering from the University of Rochester and an MS and a PhD in engineering from the University of Pennsylvania. Kendall has industrial experience in research and development environments (AT&T Bell Laboratories) as well as experience with several start-up technology firms.



Mary Anne Poatsy, MBA

mpoatsy@mc3.edu

Mary Anne is a senior faculty member at Montgomery County Community College, teaching various computer application and concepts courses in face-to-face and online environments. She enjoys speaking at various professional conferences about innovative classroom strategies. Mary Anne holds a BA in psychology and education from Mount Holyoke College and an MBA in finance from Northwestern University's Kellogg Graduate School of Management. She has been in teaching since 1997, ranging from elementary and secondary education to Montgomery County Community College, Gwynedd-Mercy College, Muhlenberg College, and Bucks County Community College, as well as training in the professional environment. Before teaching, Mary Anne was a vice president at Shearson Lehman Hutton in the Municipal Bond Investment Banking Department.

Acknowledgments

For my wife, Patricia, whose patience, understanding, and support continue to make this work possible, especially when I stay up past midnight writing! And to my parents, Jackie and Dean, who taught me the best way to achieve your goals is to constantly strive to improve yourself through education.

—Alan Evans

For all the teachers, mentors, and gurus who have popped in and out of my life.

—Kendall Martin

For my husband, Ted, who unselfishly continues to take on more than his fair share to support me throughout this process, and for my children, Laura, Carolyn, and Teddy, whose encouragement and love have been inspiring.

—Mary Anne Poatsy

First, we would like to thank our students. We constantly learn from them while teaching, and they are a continual source of inspiration and new ideas.

We could not have written this book without the loving support of our families. Our spouses and children made sacrifices (mostly in time not spent with us) to permit us to make this dream into a reality.

Although working with the entire team at Pearson has been a truly enjoyable experience, a few individuals deserve special mention. The constant support and encouragement we receive from Jenifer Niles, Executive Portfolio Product Manager, and Andrew Gilfillan, VP, Editorial Director, continually make this book grow and change. Our heartfelt thanks go to Shannon LeMay-Finn, our Developmental Editor. Her creativity, drive, and management skills helped make this book a reality. We also would like to extend our appreciation to Pearson Content Producers, particularly Laura Burgess, and the vendor teams, who work tirelessly to ensure that our book is published on time and looks fabulous. The timelines are always short, the art is complex, and there are many people with whom they have to coordinate tasks. But they make it look easy! We'd like to extend our thanks to the media and MyLab IT team—Eric Hakanson, Becca Golden, Amanda Losonsky, and Heather Darby—for all of their hard work and dedication.

There are many people whom we do not meet at Pearson and elsewhere who make significant contributions by designing the book, illustrating, composing the pages, producing the media, and securing permissions. We thank them all.

And finally, we would like to thank the reviewers and the many others who contribute their time, ideas, and talents to this project. We appreciate their time and energy, as their comments help us turn out a better product each edition. A special thanks goes to Rick Wolff, a wonderfully talented infographic designer who helped by creating the infographics for this text.

Acknowledgments for the Global Edition

Pearson would like to thank and acknowledge the following people for their contributions to the Global Edition.

Contributors

S. H. Chung – *Wawasan Open University*

Ajay Mittal – *University Institute of Engineering and Technology*

Reviewers

Kaushik Goswami – *St. Xavier's College, Kolkata*

Mazani Manaf – *Universiti Teknologi MARA*

Moumita Mitra Manna – *Bangabasi College*

Sandeep Singh – *Jaypee Institute of Information Technology*

1

The Impact of Technology in a Changing World



For a chapter overview, watch the [Chapter Overview videos](#).

PART 1

Technology in Society

Learning Outcome 1.1 You will be able to discuss the impact of the tools of modern technology on national and global issues.



Technology in a Global Society 32

Objective 1.1 Describe various technological tools being used to impact national and global issues.

Objective 1.2 Describe various global social issues that are being affected by technology.



Technology Connects Us with Others 34

Objective 1.3 Describe how technology is changing how and why we connect and collaborate with others.

Objective 1.4 Summarize how technology has impacted the way we choose and consume products and services.

Helpdesk: Technology Impacts



The Importance of Computer Literacy 36

Objective 1.5 Characterize computer literacy and explain why it is important to be computer literate.

Sound Byte: Virtual Computer Tour

PART 2

Emerging Technologies and Ethical Computing

Learning Outcome 1.2 You will be able to describe emerging technologies, such as artificial intelligence, and how technology creates new ethical debates.



Artificial Intelligence 41

Objective 1.6 Describe artificial intelligence systems and explain their main goals.

Helpdesk: The Impact of Artificial Intelligence



Working with Artificial Intelligence and Other Information Technologies 45

Objective 1.7 Describe how artificial intelligence and other emerging technologies are important in many careers.



Ethical Computing 50

Objective 1.8 Define ethics and describe various ethical systems.

Objective 1.9 Describe influences on the development of your personal ethics.

Objective 1.10 Present examples of how technology creates ethical challenges.

Sound Byte: How to Debate Ethical Issues

MyLab IT

All media accompanying this chapter can be found here.

Make This



A Virtual Assistant on **page 40**

(John M Lund Photography Inc/The Image Bank/Getty Images; Carlos Castilla/Shutterstock; Winui/Shutterstock; Ivan Trifonenko/123RF; Sergey Nivens/Shutterstock; Stuart Miles/Fotolia)