

# Discovering Computers, Complete

Your Interactive Guide to the Digital World



## Table of Contents

<b>CHAPTER 1</b>	
<b>Basic Introduction to Computers</b>	<b>2</b>
A WORLD OF COMPUTERS	4
WHAT IS A COMPUTER?	6
Data and Information	6
Information Processing Cycle	6
THE COMPONENTS OF A COMPUTER	6
Input Devices	6
Output Devices	7
System Unit	7
Storage Devices	8
Communication Devices	8
ADVANTAGES AND DISADVANTAGES OF USING COMPUTERS	9
Advantages of Using Computers	9
Disadvantages of Using Computers	9
NETWORKS AND THE INTERNET	10
The Internet	11
COMPUTER SOFTWARE	15
System Software	15
Application Software	16
Installing and Running Programs	16
Software Development	18
CATEGORIES OF COMPUTERS	18
PERSONAL COMPUTERS	19
Desktop Computers	20
MOBILE COMPUTERS AND MOBILE DEVICES	20
Notebook Computers	20
Mobile Devices	21
GAME CONSOLES	24
SERVERS	25
MAINFRAMES	25
SUPERCOMPUTERS	25
EMBEDDED COMPUTERS	26
ELEMENTS OF AN INFORMATION SYSTEM	27
EXAMPLES OF COMPUTER USAGE	28
Home User	28
Small Office/Home Office User	30
Mobile User	31
Power User	31
Enterprise User	32
Putting It All Together	32
COMPUTER APPLICATIONS IN SOCIETY	34
Education	34
Finance	34
Government	35
Health Care	36
Science	36
Publishing	37
Travel	38
Manufacturing	38
CHAPTER SUMMARY	39
HIGH-TECH TALK	40
Triangulation: Can You Find Me Now?	40
COMPANIES ON THE CUTTING EDGE	41
Apple	41
Amazon	41
TECHNOLOGY TRAILBLAZERS	41
Bill Gates	41
Tom Anderson	41
STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking	42 – 53
<b>Special Feature</b>	
<b>Computing Timeline</b>	54 – 71
<b>CHAPTER 2</b>	
<b>Fundamentals of the World Wide Web and Internet</b>	<b>72</b>
THE INTERNET	74
EVOLUTION OF THE INTERNET	75
Internet2	76
Connecting to the Internet	76
Access Providers	77
How Data and Information Travel the Internet	78
Internet Addresses	79
THE WORLD WIDE WEB	80
Browsing the Web	81
Web Addresses	82
Navigating Web Pages	83
Searching the Web	85
Types of Web Sites	88
Evaluating a Web Site	92
Multimedia on the Web	92
Web Publishing	97
E-COMMERCE	98
OTHER INTERNET SERVICES	100
E-Mail	101
Mailing Lists	103
Instant Messaging	104
Chat Rooms	105
VoIP	106
Newsgroups and Message Boards	107
FTP	107
NETIQUETTE	108
CHAPTER SUMMARY	109
HIGH-TECH TALK	110
A Computer's Internet Protocol (IP) Address	110
COMPANIES ON THE CUTTING EDGE	111
Google	111
eBay	111

<b>TECHNOLOGY TRAILBLAZERS</b> . . . . .	111
Tim Berners-Lee . . . . .	111
Mark Zuckerberg . . . . .	111
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •</b>	
Learn It Online • Problem Solving • Learn How To •	
Web Research • Critical Thinking . . . . .	112 – 123

### Special Feature

<b>Using the Web</b> . . . . .	124 – 139
--------------------------------	-----------

## CHAPTER 3

### Software for Systems 140

<b>APPLICATION SOFTWARE</b> . . . . .	142
The Role of System Software . . . . .	143
Working with Application Software . . . . .	144
<b>BUSINESS SOFTWARE</b> . . . . .	146
Word Processing Software . . . . .	147
Developing a Document . . . . .	149
Spreadsheet Software . . . . .	150
Database Software . . . . .	153
Presentation Software . . . . .	154
Note Taking Software . . . . .	156
Business Software Suite . . . . .	156
Personal Information Manager Software . . . . .	156
Business Software for Phones . . . . .	156
Project Management Software . . . . .	157
Accounting Software . . . . .	158
Document Management Software . . . . .	158
Enterprise Computing Software . . . . .	159
<b>GRAPHICS AND MULTIMEDIA SOFTWARE</b> . . . . .	159
Computer-Aided Design . . . . .	160
Desktop Publishing Software (for the Professional) . . . . .	160
Paint/Image Editing Software (for the Professional) . . . . .	161
Photo Editing Software (for the Professional) . . . . .	162
Video and Audio Editing Software (for the Professional) . . . . .	162
Multimedia Authoring Software . . . . .	162
Web Page Authoring Software . . . . .	164
<b>SOFTWARE FOR HOME, PERSONAL, AND EDUCATIONAL USE</b> . . . . .	165
Personal Finance Software . . . . .	166
Legal Software . . . . .	167
Tax Preparation Software . . . . .	167
Desktop Publishing Software (for Personal Use) . . . . .	167
Paint/Image Editing Software (for Personal Use) . . . . .	168
Photo Editing and Photo Management Software . . . . .	168
Clip Art/Image Gallery . . . . .	169
Video and Audio Editing Software (for Personal Use) . . . . .	170
Home Design/Landscaping Software . . . . .	170
Travel and Mapping Software . . . . .	170
Reference and Educational Software . . . . .	171
Entertainment Software . . . . .	172
<b>WEB APPLICATIONS</b> . . . . .	172
<b>APPLICATION SOFTWARE FOR COMMUNICATIONS</b> . . . . .	174

<b>LEARNING TOOLS FOR APPLICATION SOFTWARE</b> . . . . .	175
Web-Based Training . . . . .	176
<b>CHAPTER SUMMARY</b> . . . . .	177
<b>HIGH-TECH TALK</b> . . . . .	178
Computer Viruses: Delivery, Infection, and Avoidance . . . . .	178
<b>COMPANIES ON THE CUTTING EDGE</b> . . . . .	179
Adobe Systems . . . . .	179
Microsoft . . . . .	179
<b>TECHNOLOGY TRAILBLAZERS</b> . . . . .	179
Dan Bricklin . . . . .	179
Masayoshi Son . . . . .	179
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •</b>	
Learn It Online • Problem Solving • Learn How To •	
Web Research • Critical Thinking . . . . .	180 – 191

### Special Feature

<b>Communication in the Digital Age</b> . . . . .	192 – 207
---	-----------

## CHAPTER 4

### System Unit Components 208

<b>THE SYSTEM UNIT</b> . . . . .	210
The Motherboard . . . . .	212
<b>PROCESSOR</b> . . . . .	213
The Control Unit . . . . .	214
The Arithmetic Logic Unit . . . . .	214
Machine Cycle . . . . .	215
Registers . . . . .	216
The System Clock . . . . .	216
Comparison of Personal Computer Processors . . . . .	216
Buying a Personal Computer . . . . .	218
Processor Cooling . . . . .	219
Parallel Processing . . . . .	220
<b>DATA REPRESENTATION</b> . . . . .	221
<b>MEMORY</b> . . . . .	223
Bytes and Addressable Memory . . . . .	223
Memory Sizes . . . . .	223
Types of Memory . . . . .	223
RAM . . . . .	224
Cache . . . . .	227
ROM . . . . .	228
Flash Memory . . . . .	228
CMOS . . . . .	229
Memory Access Times . . . . .	229
<b>EXPANSION SLOTS AND ADAPTER CARDS</b> . . . . .	230
Removable Flash Memory . . . . .	231
<b>PORTS AND CONNECTORS</b> . . . . .	232
USB Ports . . . . .	234
FireWire Ports . . . . .	234
Other Ports . . . . .	234
Port Replicators and Docking Stations . . . . .	236
<b>BUSES</b> . . . . .	237
Expansion Bus . . . . .	238
<b>BAYS</b> . . . . .	238
<b>POWER SUPPLY</b> . . . . .	239

PUTTING IT ALL TOGETHER	239
KEEPING YOUR COMPUTER OR MOBILE DEVICE CLEAN	240
CHAPTER SUMMARY	241
HIGH-TECH TALK	242
Random Access Memory (RAM): The Genius of Memory	242
COMPANIES ON THE CUTTING EDGE	243
NVIDIA	243
Intel	243
TECHNOLOGY TRAILBLAZERS	243
Jack Kilby	243
Gordon Moore	243
STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking	244 – 255

## CHAPTER 5

### Understanding Input

256

WHAT IS INPUT?	258
WHAT ARE INPUT DEVICES?	260
THE KEYBOARD	260
Keyboard Ergonomics	262
Keyboards for Mobile Computers and Mobile Devices	262
POINTING DEVICES	263
MOUSE	263
Using a Mouse	264
OTHER POINTING DEVICES	265
Trackball	265
Touchpad	265
Pointing Stick	266
TOUCH SCREENS AND TOUCH-SENSITIVE PADS	266
Touch-Sensitive Pads	267
PEN INPUT	268
OTHER INPUT FOR SMART PHONES	268
GAME CONTROLLERS	270
Gamepads	270
Joysticks and Wheels	270
Light Guns	270
Dance Pads	270
Motion-Sensing Game Controllers	271
Other Game Controllers	271
DIGITAL CAMERAS	272
Digital Camera Photo Quality	273
VOICE INPUT	274
Audio Input	274
VIDEO INPUT	275
Web Cams	275
Video Conferencing	276
SCANNERS AND READING DEVICES	277
Optical Scanners	277
Optical Readers	279
Bar Code Readers	280
RFID Readers	280
Magnetic Stripe Card Readers	281

MICR Readers	281
Data Collection Devices	282
BIOMETRIC INPUT	282
TERMINALS	284
Point-of-Sale Terminals	284
Automated Teller Machines	284
DVD Kiosks	285
PUTTING IT ALL TOGETHER	285
INPUT DEVICES FOR PHYSICALLY CHALLENGED USERS	286
CHAPTER SUMMARY	287
HIGH-TECH TALK	288
Biometrics: Personalized Security	288
COMPANIES ON THE CUTTING EDGE	289
Logitech	289
Nokia	289
TECHNOLOGY TRAILBLAZERS	289
Satoru Iwata	289
Douglas Engelbart	289
STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking	290 – 301

## CHAPTER 6

### Understanding Output

302

WHAT IS OUTPUT?	304
DISPLAY DEVICES	306
LCD Monitors and LCD Screens	307
LCD Technology	308
LCD Quality	308
Graphics Chips, Ports, and LCD Monitors	310
Plasma Monitors	311
Televisions	312
CRT Monitors	313
PRINTERS	313
Producing Printed Output	314
Nonimpact Printers	315
Ink-Jet Printers	316
Photo Printers	318
Laser Printers	319
Multifunction Peripherals	320
Thermal Printers	321
Mobile Printers	321
Label and Postage Printers	322
Plotters and Large-Format Printers	322
Impact Printers	322
SPEAKERS, HEADPHONES, AND EARBUDS	323
OTHER OUTPUT DEVICES	325
Data Projectors	325
Interactive Whiteboards	326
Force-Feedback Game Controllers and Tactile Output	326
PUTTING IT ALL TOGETHER	327
OUTPUT DEVICES FOR PHYSICALLY CHALLENGED USERS	328
CHAPTER SUMMARY	329
HIGH-TECH TALK	330
3-D Graphics: Creating a Realistic Experience	330

<b>COMPANIES ON THE CUTTING EDGE</b> .....	331
HP .....	331
Samsung Electronics .....	331
<b>TECHNOLOGY TRAILBLAZERS</b> .....	331
Steve Jobs .....	331
Ursula Burns .....	331
<b>STUDENT ASSIGNMENTS:</b> Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking .....	332 – 343

### Special Feature

## Video Technology in the Digital World .....

344 – 349

## CHAPTER 7

### Types of Storage .....

350

<b>STORAGE</b> .....	352
<b>HARD DISKS</b> .....	355
Characteristics of a Hard Disk .....	357
RAID .....	360
NAS .....	360
External and Removable Hard Disks .....	360
Miniature Hard Disks .....	361
Hard Disk Controllers .....	361
Maintaining Data Stored on a Hard Disk .....	362
<b>FLASH MEMORY STORAGE</b> .....	362
Solid State Drives .....	363
Memory Cards .....	364
USB Flash Drives .....	367
ExpressCard Modules .....	367
<b>CLOUD STORAGE</b> .....	368
<b>OPTICAL DISCS</b> .....	370
Care of Optical Discs .....	371
Types of Optical Discs .....	372
CDs .....	372
Archive Discs and Picture CDs .....	374
DVDs and Blu-ray Discs .....	375
<b>OTHER TYPES OF STORAGE</b> .....	376
Tape .....	376
Magnetic Stripe Cards and Smart Cards .....	377
Microfilm and Microfiche .....	378
Enterprise Storage .....	379
<b>PUTTING IT ALL TOGETHER</b> .....	380
<b>CHAPTER SUMMARY</b> .....	381
<b>HIGH-TECH TALK</b> .....	382
DNS Servers: How Devices on the Internet Easily Locate Each Other .....	382
<b>COMPANIES ON THE CUTTING EDGE</b> .....	383
Seagate Technology .....	383
SanDisk Corporation .....	383
<b>TECHNOLOGY TRAILBLAZERS</b> .....	383
Al Shugart .....	383
Mark Dean .....	383
<b>STUDENT ASSIGNMENTS:</b> Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking .....	384 – 395

## CHAPTER 8

### Types of Utility Programs and Operating Systems

396

<b>SYSTEM SOFTWARE</b> .....	398
<b>OPERATING SYSTEMS</b> .....	398
<b>OPERATING SYSTEM FUNCTIONS</b> .....	400
Starting and Shutting Down a Computer .....	400
Providing a User Interface .....	402
Managing Programs .....	404
Managing Memory .....	406
Coordinating Tasks .....	407
Configuring Devices .....	408
Establishing an Internet Connection .....	408
Monitoring Performance .....	408
Providing File Management and Other Utilities .....	409
Updating Software Automatically .....	409
Controlling a Network .....	410
Administering Security .....	410
<b>TYPES OF OPERATING SYSTEMS</b> .....	411
<b>STAND-ALONE OPERATING SYSTEMS</b> .....	412
Windows 7 .....	413
Mac OS X .....	415
UNIX .....	416
Linux .....	416
<b>SERVER OPERATING SYSTEMS</b> .....	417
Windows Server 2008 .....	417
UNIX .....	418
Linux .....	418
Solaris .....	418
NetWare .....	418
<b>EMBEDDED OPERATING SYSTEMS</b> .....	418
Windows Embedded CE .....	419
Windows Phone 7 .....	419
Palm OS .....	419
iPhone OS .....	420
BlackBerry .....	420
Google Android .....	420
Embedded Linux .....	420
Symbian OS .....	420
<b>UTILITY PROGRAMS</b> .....	421
File Manager .....	422
Search Utility .....	422
Image Viewer .....	423
Uninstaller .....	423
Disk Cleanup .....	423
Disk Defragmenter .....	423
Backup and Restore Utilities .....	424
Screen Saver .....	425
Personal Firewall .....	425
Antivirus Programs .....	425
Spyware and Adware Removers .....	426
Internet Filters .....	426
File Compression .....	427
Media Player .....	427
Disc Burning .....	428
Personal Computer Maintenance .....	428
<b>CHAPTER SUMMARY</b> .....	429

<b>HIGH-TECH TALK</b> .....	430
Touch Screen Technology: How the Screen Is So Smart .....	430
<b>COMPANIES ON THE CUTTING EDGE</b> .....	431
VeriSign .....	431
Research In Motion (RIM) .....	431
<b>TECHNOLOGY TRAILBLAZERS</b> .....	431
Steve Wozniak .....	431
Linus Torvalds .....	431
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •     Learn It Online • Problem Solving • Learn How To •     Web Research • Critical Thinking</b> .....	432 – 443

### Special Feature

<b>Guide for Buyers</b> .....	444 – 456
-------------------------------	-----------

## CHAPTER 9

# Networks and Communications 458

<b>COMMUNICATIONS</b> .....	460
<b>USES OF COMPUTER COMMUNICATIONS</b> .....	461
Blogs, Chat Rooms, E-Mail, Fax, FTP, Instant Messaging, Internet, Newsgroups, RSS, Video Conferencing, VoIP, Web, Web 2.0, Web Folders, and Wikis .....	462
Wireless Messaging Services .....	462
Wireless Internet Access Points .....	464
Cybercafés .....	466
Global Positioning Systems .....	466
Groupware .....	467
Voice Mail .....	467
Collaboration .....	468
Web Services .....	469
<b>NETWORKS</b> .....	470
LANs, MANs, and WANs .....	471
Network Architectures .....	473
Network Topologies .....	475
Intranets .....	477
<b>NETWORK COMMUNICATIONS STANDARDS</b> .....	477
Ethernet .....	478
Token Ring .....	478
TCP/IP .....	478
Wi-Fi .....	479
Bluetooth .....	480
UWB .....	480
IrDA .....	480
RFID .....	481
WiMAX .....	482
WAP .....	482
<b>COMMUNICATIONS SOFTWARE</b> .....	482
<b>COMMUNICATIONS OVER THE TELEPHONE NETWORK</b> .....	482
Dial-Up Lines .....	483
Dedicated Lines .....	483
ISDN Lines .....	484
DSL .....	484
FTTP .....	484
T-Carrier Lines .....	484
ATM .....	485
<b>COMMUNICATIONS DEVICES</b> .....	485
Dial-Up Modems .....	485
Digital Modems: ISDN, DSL, and Cable .....	486
Wireless Modems .....	487

Network Cards .....	487
Wireless Access Points .....	487
Routers .....	488
Hubs and Switches .....	488
<b>HOME NETWORKS</b> .....	489
Wired Home Networks .....	489
Wireless Home Networks .....	490
<b>COMMUNICATIONS CHANNEL</b> .....	491
<b>PHYSICAL TRANSMISSION MEDIA</b> .....	492
Twisted-Pair Cable .....	493
Coaxial Cable .....	493
Fiber-Optic Cable .....	493
<b>WIRELESS TRANSMISSION MEDIA</b> .....	494
Infrared .....	494
Broadcast Radio .....	494
Cellular Radio .....	495
Microwaves .....	496
Communications Satellite .....	496
<b>CHAPTER SUMMARY</b> .....	497
<b>HIGH-TECH TALK</b> .....	498
OSI Reference Model: The Driving Force behind Network Communications .....	498
<b>COMPANIES ON THE CUTTING EDGE</b> .....	499
Cisco Systems .....	499
Verizon .....	499
<b>TECHNOLOGY TRAILBLAZERS</b> .....	499
Robert Metcalfe .....	499
Patricia Russo .....	499
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •     Learn It Online • Problem Solving • Learn How To •     Web Research • Critical Thinking</b> .....	500 – 511

## CHAPTER 10

# Managing a Database 512

<b>DATABASES, DATA, AND INFORMATION</b> .....	514
Data Integrity .....	516
Qualities of Valuable Information .....	516
<b>THE HIERARCHY OF DATA</b> .....	517
Characters .....	518
Fields .....	518
Records .....	519
Files .....	519
<b>MAINTAINING DATA</b> .....	520
Adding Records .....	520
Modifying Records .....	521
Deleting Records .....	522
Validating Data .....	522
<b>FILE PROCESSING VERSUS DATABASES</b> .....	524
File Processing Systems .....	524
The Database Approach .....	524
<b>DATABASE MANAGEMENT SYSTEMS</b> .....	526
Data Dictionary .....	527
File Retrieval and Maintenance .....	528
Data Security .....	531
Backup and Recovery .....	531
<b>RELATIONAL, OBJECT-ORIENTED, AND MULTIDIMENSIONAL DATABASES</b> .....	533
Relational Databases .....	533
Object-Oriented Databases .....	534

Multidimensional Databases	535
<b>WEB DATABASES</b>	536
<b>DATABASE ADMINISTRATION</b>	537
Database Design Guidelines	537
Role of the Database Analysts and Administrators	538
Role of the Employee as a User	538
<b>CHAPTER SUMMARY</b>	539
<b>HIGH-TECH TALK</b>	540
Normalization: Ensuring Data Consistency	540
<b>COMPANIES ON THE CUTTING EDGE</b>	541
Oracle	541
Sybase	541
<b>TECHNOLOGY TRAILBLAZERS</b>	541
E. F. Codd	541
Larry Ellison	541
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •</b>	
Learn It Online • Problem Solving • Learn How To •	
Web Research • Critical Thinking	542 – 553

## CHAPTER 11

### Manage Computing Securely, Safely, and Ethically

554

<b>COMPUTER SECURITY RISKS</b>	556
<b>INTERNET AND NETWORK ATTACKS</b>	558
Computer Viruses, Worms, Trojan Horses, and Rootkits	558
Safeguards against Computer Viruses and Other Malware	560
Botnets	562
Denial of Service Attacks	562
Back Doors	562
Spoofing	563
Safeguards against Botnets, DoS/DDoS Attacks, Back Doors, and Spoofing	563
Firewalls	563
Intrusion Detection Software	564
Honey pots	564
<b>UNAUTHORIZED ACCESS AND USE</b>	564
Safeguards against Unauthorized Access and Use	565
Identifying and Authenticating Users	565
Digital Forensics	569
<b>HARDWARE THEFT AND VANDALISM</b>	570
Safeguards against Hardware Theft and Vandalism	570
<b>SOFTWARE THEFT</b>	571
Safeguards against Software Theft	571
<b>INFORMATION THEFT</b>	572
Safeguards against Information Theft	572
Encryption	573
<b>SYSTEM FAILURE</b>	575
Safeguards against System Failure	576
<b>BACKING UP — THE ULTIMATE SAFEGUARD</b>	577
<b>WIRELESS SECURITY</b>	577
<b>HEALTH CONCERNS OF COMPUTER USE</b>	579
Computers and Health Risks	579
Ergonomics and Workplace Design	580
Computer Addiction	581
<b>ETHICS AND SOCIETY</b>	581
Information Accuracy	582
Intellectual Property Rights	582

Codes of Conduct	582
Green Computing	583
<b>INFORMATION PRIVACY</b>	584
Electronic Profiles	585
Cookies	585
Spam	587
Phishing	587
Spyware and Adware	588
Privacy Laws	588
Social Engineering	590
Employee Monitoring	590
Content Filtering	590
<b>CHAPTER SUMMARY</b>	591
<b>HIGH-TECH TALK</b>	592
Encryption Algorithms: The Brains behind Encryption	592
<b>COMPANIES ON THE CUTTING EDGE</b>	593
McAfee	593
Symantec	593
<b>TECHNOLOGY TRAILBLAZERS</b>	593
Richard Stallman	593
Gene Spafford	593
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint •</b>	
Learn It Online • Problem Solving • Learn How To •	
Web Research • Critical Thinking	594 – 605

### Special Feature

<b>Forensics in the Digital Age</b>	606 – 616
-------------------------------------	-----------

## CHAPTER 12

### Exploring Information System Development

618

<b>WHAT IS SYSTEM DEVELOPMENT?</b>	620
System Development Phases	620
System Development Guidelines	621
Who Participates in System Development?	622
Project Management	623
Feasibility Assessment	624
Documentation	625
Data and Information Gathering Techniques	625
<b>WHAT INITIATES A SYSTEM DEVELOPMENT PROJECT?</b>	626
Horizon Community College – A Case Study	628
<b>PLANNING PHASE</b>	628
Planning at Horizon Community College	629
<b>ANALYSIS PHASE</b>	629
The Preliminary Investigation	629
Preliminary Investigation at Horizon Community College	631
Detailed Analysis	631
Process Modeling	631
Object Modeling	634
The System Proposal	635
Detailed Analysis at Horizon Community College	637
<b>DESIGN PHASE</b>	638
Acquiring Necessary Hardware and Software	638
Identifying Technical Specifications	638
Soliciting Vendor Proposals	638
Testing and Evaluating Vendor Proposals	639
Making a Decision	640
Hardware Acquisition at Horizon Community College	640

Detailed Design	640
Prototyping	641
CASE Tools	642
Quality Review Techniques	642
Detailed Design at Horizon Community College	643
<b>IMPLEMENTATION PHASE</b>	643
Develop Programs	643
Install and Test the New System	643
Train Users	644
Convert to the New System	644
Implementation at Horizon Community College	645
<b>OPERATION, SUPPORT, AND SECURITY PHASE</b>	645
Developing a Computer Security Plan	646
Operation, Support, and Security at Horizon Community College	646
<b>CHAPTER SUMMARY</b>	647
<b>HIGH-TECH TALK</b>	648
Benchmarking: Testing Performance through Calculations	648
<b>COMPANIES ON THE CUTTING EDGE</b>	649
Computer Sciences Corporation (CSC)	649
Wikimedia Foundation	649
<b>TECHNOLOGY TRAILBLAZERS</b>	649
Ed Yourdon	649
Tom DeMarco	649
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking</b>	650 – 661

## CHAPTER 13

### Computer Programs and Programming Languages 662

<b>COMPUTER PROGRAMS AND PROGRAMMING LANGUAGES</b>	664
<b>LOW-LEVEL LANGUAGES</b>	665
<b>PROCEDURAL LANGUAGES</b>	666
C	668
COBOL	668
<b>OBJECT-ORIENTED PROGRAMMING LANGUAGES AND PROGRAM DEVELOPMENT TOOLS</b>	669
Java	670
.NET	670
C++	671
C#	671
F#	671
Visual Studio	671
Visual Programming Languages	673
Delphi	673
PowerBuilder	674
<b>OTHER PROGRAMMING LANGUAGES AND DEVELOPMENT TOOLS</b>	674
4GLs	674
Classic Programming Languages	675
Application Generators	676
Macros	676
<b>WEB PAGE DEVELOPMENT</b>	678
HTML and XHTML	678
XML and WML	679

Scripts, Applets, Servlets, and ActiveX Controls	680
CGI Scripts	680
Scripting Languages	682
Dynamic HTML	683
Ruby on Rails	683
Web 2.0 Program Development	684
Web Page Authoring Software	685
<b>MULTIMEDIA PROGRAM DEVELOPMENT</b>	685
<b>PROGRAM DEVELOPMENT</b>	686
What Initiates Program Development?	687
<b>STEP 1 — ANALYZE REQUIREMENTS</b>	687
<b>STEP 2 — DESIGN SOLUTION</b>	687
Structured Design	688
Object-Oriented Design	689
Control Structures	689
Design Tools	691
<b>STEP 3 — VALIDATE DESIGN</b>	693
<b>STEP 4 — IMPLEMENT DESIGN</b>	694
Extreme Programming	695
<b>STEP 5 — TEST SOLUTION</b>	695
<b>STEP 6 — DOCUMENT SOLUTION</b>	696
<b>CHAPTER SUMMARY</b>	697
<b>HIGH-TECH TALK</b>	698
Acid3 Browser Test: Verifying Standards Support	698
<b>COMPANIES ON THE CUTTING EDGE</b>	699
Electronic Arts (EA)	699
Sun Microsystems	699
<b>TECHNOLOGY TRAILBLAZERS</b>	699
Alan Kay	699
James Gosling	699
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking</b>	700 – 711

### Special Feature

### Program Development for Web 2.0 712 – 717

## CHAPTER 14

### Enterprise Computing 718

<b>WHAT IS ENTERPRISE COMPUTING?</b>	720
Types of Enterprises	722
Organizational Structure of an Enterprise	722
Levels of Users in the Enterprise	724
How Managers Use Information	725
<b>INFORMATION SYSTEMS IN THE ENTERPRISE</b>	726
Information Systems within Functional Units	726
General Purpose Information Systems	732
Integrated Information Systems	737
<b>ENTERPRISE-WIDE TECHNOLOGIES AND METHODOLOGIES</b>	740
Portals	740
Data Warehouses	741
Communications	742
Extranets	742
Web Services	742
Service-Oriented Architecture	743

Document Management Systems . . . . .	743
Workflow . . . . .	744
Virtual Private Network . . . . .	744
<b>VIRTUALIZATION AND CLOUD COMPUTING</b> . . . . .	745
Virtualization . . . . .	745
Cloud and Grid Computing . . . . .	746
<b>E-COMMERCE</b> . . . . .	747
<b>ENTERPRISE HARDWARE</b> . . . . .	748
RAID . . . . .	748
Network Attached Storage and Storage Area Networks . . . . .	749
Enterprise Storage Systems . . . . .	750
Blade Servers . . . . .	751
Thin Clients . . . . .	752
<b>HIGH-AVAILABILITY, SCALABILITY, AND INTEROPERABILITY</b> . . . . .	752
High-Availability Systems . . . . .	752
Scalability . . . . .	753
Interoperability . . . . .	753
<b>BACKUP PROCEDURES</b> . . . . .	754
Disaster Recovery Plan . . . . .	755
<b>CHAPTER SUMMARY</b> . . . . .	757
<b>HIGH-TECH TALK</b> . . . . .	758
Neural Networks: Learning from Experience . . . . .	758
<b>COMPANIES ON THE CUTTING EDGE</b> . . . . .	759
EMC . . . . .	759
IBM . . . . .	759
<b>TECHNOLOGY TRAILBLAZERS</b> . . . . .	759
Chad Hurley . . . . .	759
Anita Borg . . . . .	759
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking</b> . . . . .	760 – 771

### Special Feature

## Case Study in Enterprise Order Processing . . . . . 772 – 781

## CHAPTER 15

### Careers in Computers and Certification

782

<b>THE COMPUTER INDUSTRY</b> . . . . .	784
<b>CAREERS IN THE COMPUTER INDUSTRY</b> . . . . .	786
General Business and Government . . . . .	
Organizations and Their IT Departments . . . . .	786
Computer Equipment Field . . . . .	790
Computer Software Field . . . . .	790
Computer Service and Repair Field . . . . .	791
Computer Sales . . . . .	792
Computer Education and Training Field . . . . .	792
IT Consulting . . . . .	793

<b>PREPARING FOR A CAREER IN THE COMPUTER INDUSTRY</b> . . . . .	794
Attending a Trade School . . . . .	794
Attending a College or University . . . . .	794
Searching for Computer-Related Jobs . . . . .	796
Planning for Career Development . . . . .	797
Professional Organizations and Personal Networks . . . . .	797
Professional Growth and Continuing Education . . . . .	798
Computer Publications and Web Sites . . . . .	799
<b>CERTIFICATION</b> . . . . .	800
Certification Benefits . . . . .	800
Choosing a Certification . . . . .	802
Preparing for Certification . . . . .	802
Certification Examinations . . . . .	803
<b>A GUIDE TO CERTIFICATION</b> . . . . .	803
Application Software Certifications . . . . .	804
Operating System Certifications . . . . .	804
Programmer/Developer Certifications . . . . .	805
Hardware Certifications . . . . .	805
Networking Certifications . . . . .	806
Digital Forensics Certifications . . . . .	806
Security Certifications . . . . .	807
Internet Certifications . . . . .	807
Database System Certifications . . . . .	807
<b>CHAPTER SUMMARY</b> . . . . .	808
<b>HIGH-TECH TALK</b> . . . . .	810
Bioinformatics: Technology Collides with Biology . . . . .	810
<b>COMPANIES ON THE CUTTING EDGE</b> . . . . .	811
Dice . . . . .	811
Dell . . . . .	811
<b>TECHNOLOGY TRAILBLAZERS</b> . . . . .	811
Steve Ballmer . . . . .	811
Jerry Yang and David Filo . . . . .	811
<b>STUDENT ASSIGNMENTS: Chapter Review • Key Terms • Checkpoint • Learn It Online • Problem Solving • Learn How To • Web Research • Critical Thinking</b> . . . . .	812 – 823

### Special Feature

## Your Life in a Digital World . . . . . 824 – 830

Appendix A: Quiz Yourself Answers . . . . .	APP 1
Appendix B: Computer Acronyms . . . . .	APP 9
Appendix C: Coding Schemes and Number Systems . . . . .	APP 17
<b>GLOSSARY/INDEX</b> . . . . .	IND 1
<b>PHOTO CREDITS</b> . . . . .	IND 44