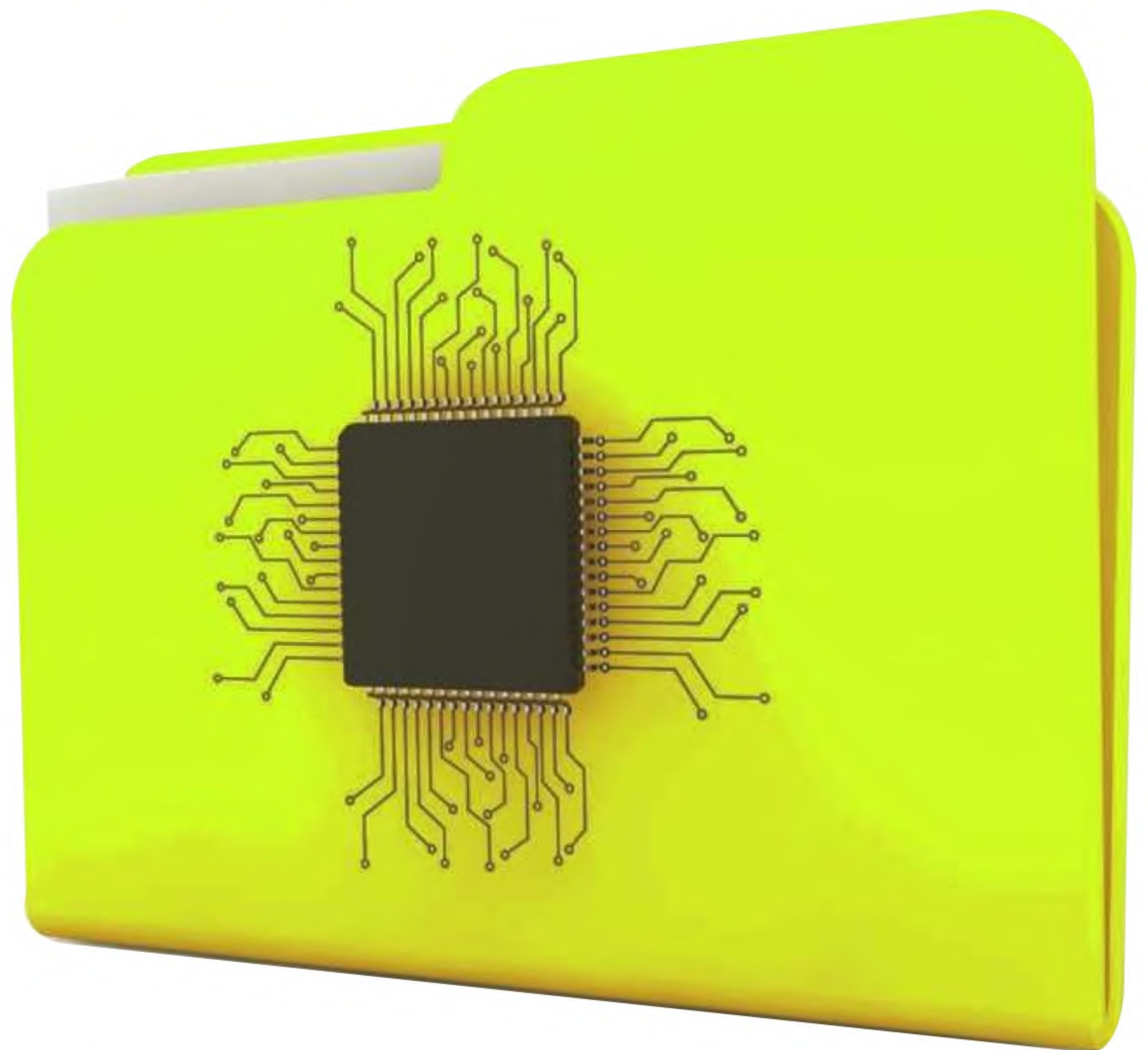


PRINCIPLES OF BUSINESS INFORMATION SYSTEMS

THIRD
EDITION



RALPH STAIR,
GEORGE REYNOLDS
AND THOMAS CHESNEY



Australia • Brazil • Mexico • Singapore • United Kingdom • United States

Principles of Business Information Systems 3rd Edition
Ralph Stair, George Reynolds and Thomas Chesney

Publisher: Annabel Ainscow

List Manager: Abigail Coppin

Content Project Manager:
Melissa Beavis

Manufacturing Manager: Eyvett Davis

Marketing Manager: Anna Reading

Typesetter: Lumina Datamatics

Cover Design: Simon Levy Associates

Text design: Design Deluxe Ltd

Cover Image(s): istock

© 2018, Cengage Learning EMEA

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced or distributed in any form or by any means, except as permitted by U.S. copyright law, without the prior written permission of the copyright owner.

For product information and technology assistance, contact us at
emea.info@cengage.com

For permission to use material from this text or product and for permission queries, email **emea.permissions@cengage.com**

British Library Cataloguing-in-Publication Data

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

ISBN: 978-1-4737-4841-5

Cengage EMEA

Cheriton House, North Way
Andover, Hampshire, SP10 5BE
United Kingdom

Cengage is a leading provider of customized learning solutions with employees residing in nearly 40 different countries and sales in more than 125 countries around the world. Find your local representative at: **www.cengage.co.uk**

Cengage products are represented in Canada by
Nelson Education, Ltd.

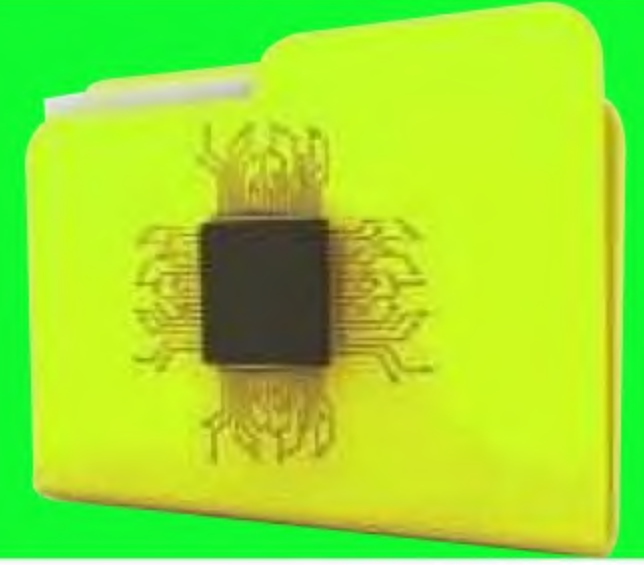
For your course and learning solutions, visit **www.cengage.co.uk**

Purchase any of our products at your local college store or at our preferred online store **www.cengagebrain.com**.

For Tahseena



Brief Contents



- 1 Overview** 1
 - 1** An Introduction to Information Systems 3
 - 2** Information Systems in Organizations 33

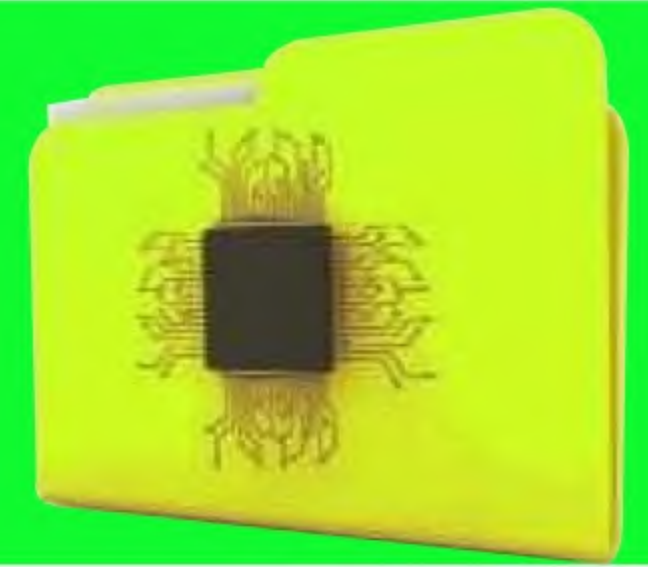
- 2 Information Technology Concepts** 63
 - 3** Hardware: Input, Processing, Output and Storage Devices 65
 - 4** Software: Systems and Application Software 115
 - 5** Organizing and Storing Data 157
 - 6** Computer Networks 187

- 3 Business Information Systems** 231
 - 7** Operational Systems 233
 - 8** Management Information and Decision Support Systems 265
 - 9** Knowledge Management and Specialized Information Systems 305
 - 10** Pervasive Computing 335

- 4 Systems Development** 365
 - 11** Systems Analysis 367
 - 12** Systems Design and Implementation 409

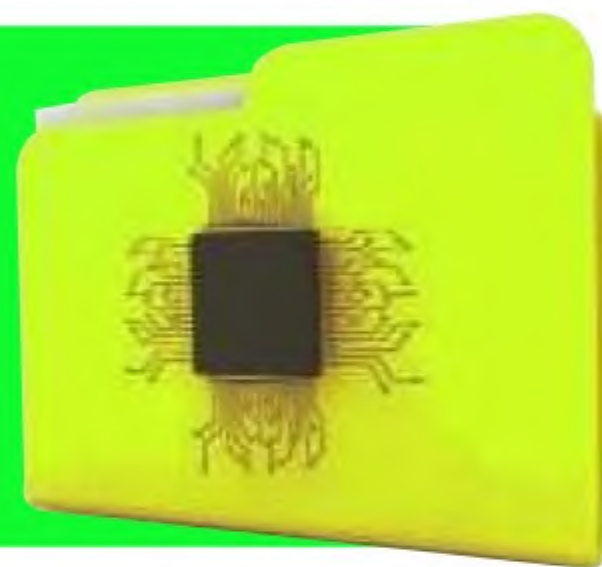
- 5 Information Systems in Business and Society** 447
 - 13** Security, Privacy and Ethical Issues in Information Systems 449

Contents



Preface xiii
 Approach of the Text xiii
 Goals of this Text xiv
Changes to the Second Edition xvii
Structure of the Text xix
About the Authors xxi
 Acknowledgements xxi
Digital Resources Page xxii

1 Overview 1



1 An Introduction to Information Systems 3

Principles 3
Learning Objectives 3
Why Learn About Information Systems? 4
What is an Information System? 4
 What is a System? 4
 What is Information? 6
 What is an Information System? 6
 The Characteristics of Valuable Information 7
 Manual and Computerized Information Systems 8
Business Information Systems 12
 Information Systems @ Work: Translating Shakespeare into Dothraki 12
 Enterprise Systems: Transaction Processing Systems and Enterprise Resource Planning 13
 MIS and DSS 16
 Knowledge Management, Artificial Intelligence, Expert Systems and Virtual Reality 17

Systems Development 19

Systems Investigation and Analysis 20
 Systems Design, Implementation, and Maintenance and Review 20

Information Systems in Society, Business and Industry 21

Ethical and Societal Issues: Robots on the Loose! 21
 Security, Privacy and Ethical Issues in Information Systems and the Internet 22
 Computer and Information Systems Literacy 23
 Information Systems in the Functional Areas of Business 24
 Information Systems in Industry 24

Global Challenges in Information Systems 24

 Summary 26
 Self-Assessment Test 28
 Review Questions 28
 Discussion Questions 28
 Web Exercises 28
 Case One: When Online Surveys Go Awry 29
 Case Two: Health Information Systems in South Africa 30
 Case Three: Australian Drones Join The Postal Service 31
 Notes 32

2 Information Systems in Organizations 33

Principles 33
Learning Objectives 33
Why Learn About Information Systems in Organizations? 34
An Introduction to Organizations 34
 Organizational Structures 36
 Organizational Change 39

Ethical and Societal Issues: Customers
 Out of Pocket After Direct Transfer Error 41
Reengineering and Continuous Improvement 43
User Satisfaction and Technology
Acceptance 44
Information Systems @ Work: Neto Helps
 Australian Small Businesses Get Online 45
The Applications Portfolio 46
Success Factors 47

Competitive Advantage 48

Factors That Lead Firms to Seek Competitive
Advantage 48

Evaluating IS 49

Productivity 49
Return on Investment and the Value
of Information Systems 50

Careers in Information Systems 51

Operations 51
Systems Development 51
Support 52
Information Service Units 53
Typical IS Titles and Functions 53

Summary 54

Self-Assessment Test 56

Review Questions 56

Discussion Questions 56

Web Exercises 56

Case One: Cloud Computing and Social Media
 Make Nail Polish Success 57

Case Two: Can You Solve It? 58

Case Three: Raining Wine from the Cloud 60

Notes 60

World Views Case: ABAZONG Training and
 Consulting (Pty) Ltd Helps Organizations and
 Users With Information Security Consultation
 and Training Awareness 61

2 Information Technology Concepts 63



3 Hardware: Input, Processing, Output and Storage Devices 65

Principles 65

Learning Objectives 65

Why Learn About Hardware? 66

Computer Systems: Integrating the Power of Technology 66

Hardware Components 67

Hardware Components in Action 68

Processing and Memory Devices: Power, Speed and Capacity 68

Processing Characteristics and Functions 69

Memory Characteristics and Functions 70

Multiprocessing 72

Parallel Computing 73

Secondary Storage 74

Access Methods 75

Secondary Storage Devices 75

Enterprise Storage Options 78

Input and Output Devices: The Gateway to Computer Systems 81

Characteristics and Functionality 81

Input Devices 82

Output Devices 87

Computer System Types 91

Portable Computers 93

Nonportable Single-User Computers 95

Multiple-User Computer Systems 96

Information Systems @ Work: Printers Arrive
 in the Operating Theatre 97

Green Computing 101

Ethical and Societal Issues: Mobile

Technology Fighting Human Trafficking 103

Summary 104

Self-Assessment Test 105

Review Questions 106

Discussion Questions 106

Web Exercises 106

Case One: Moore's Law About to Be Overturned
 106

Case Two: Sen.Se is Helping to Create the
 Internet of Things 108

Case Three: The €30 computer 109

Notes 110

4 Software: Systems and Application Software 115

Principles 115

Learning Objectives 115

Why Learn about Systems and Application
 Software? 116

An Overview of Software 116

Systems Software 116

Application Software 117

<i>Supporting Individual, Group and Organizational Goals</i> 117	<i>Relationships Between Tables</i> 160
Systems Software 118	<i>Designing Relational Databases</i> 161
<i>Operating Systems</i> 118	Database Management Systems 165
<i>Current Operating Systems</i> 122	<i>Creating and Modifying the Database</i> 165
Information Systems @ Work: Privacy for Everyone, Everywhere 123	<i>Storing and Retrieving Data</i> 166
<i>Workgroup Operating Systems</i> 125	<i>Manipulating Data and Generating Reports</i> 167
<i>Enterprise Operating Systems</i> 126	<i>Database Administration</i> 168
<i>Operating Systems for Small Computers, Embedded Computers and Special-Purpose Devices</i> 126	<i>Selecting a Database Management System</i> 169
<i>Utility Programs</i> 127	<i>Using Databases with Other Software</i> 169
<i>Middleware</i> 129	Database Applications 170
Application Software 129	<i>Linking Databases to the Internet</i> 170
<i>Overview of Application Software</i> 129	<i>Big Data Applications</i> 170
<i>Personal Application Software</i> 131	<i>Data Warehouses</i> 171
<i>Mobile Application Software</i> 135	Ethical and Societal Issues: Three Words and a Few Symbols Cost a Business €40m 172
<i>Workgroup Application Software</i> 136	<i>Data Mining</i> 173
<i>Enterprise Application Software</i> 137	<i>Business Intelligence</i> 174
<i>Application Software for Information, Decision Support and Competitive Advantage</i> 138	Information Systems @ Work: The IBM Quantum Experience 175
Programming Languages 138	<i>Distributed Databases</i> 177
Ethical and Societal Issues: Adblockers: Salvation for Web Users Or a High-Tech Protection Racket? 139	<i>Online Analytical Processing (OLAP)</i> 178
<i>The Evolution of Programming Languages</i> 140	<i>Visual, Audio and Other Database Systems</i> 179
<i>Visual, Object-Oriented and Artificial Intelligence Languages</i> 140	Summary 180
Software Issues and Trends 142	Self-Assessment Test 181
<i>Software Bugs</i> 142	Review Questions 181
<i>Copyrights and Licences</i> 143	Discussion Questions 181
<i>Freeware and Open-Source Software</i> 143	Web Exercises 181
<i>Software Upgrades</i> 145	Case One: Just Tell Me My Password Already! 182
<i>Global Software Support</i> 146	Case Two: Reading Every Book That's Ever Been Written 183
Summary 146	Case Three: Life Is Short. Protect Your Data 184
Self-Assessment Test 148	Notes 185
Review Questions 149	6 Computer Networks 187
Discussion Questions 149	Principles 187
Web Exercises 149	Learning Objectives 187
Case One: Software Cuts Legal Costs 149	Why Learn About Computer Networks? 188
Case Two: Ready. Steady. Go! 151	Telecommunications 188
Case Three: Software Error Dooms Spacecraft 152	<i>Channel Bandwidth</i> 189
Notes 153	<i>Guided Transmission Media Types</i> 189
5 Organizing and Storing Data 157	<i>Wireless Transmission Media Types</i> 192
Principles 157	<i>Telecommunications Hardware</i> 195
Learning Objectives 157	Networks and Distributed Processing 197
Why Learn About Organizing Data? 158	<i>Network Types</i> 197
Data Management and Data Modelling 158	Ethical and Societal Issues: The Great British Data Grab 199
	<i>Distributed Processing</i> 202
	<i>Client/Server Systems</i> 203
	<i>Communications Software</i> 204

Securing Data Transmission 206

Virtual Private Network (VPN) 207

The Internet 208

How the Internet Works 209

Internet Applications 211

The World Wide Web 212

Information Systems @ Work: Tech Firms

Plan the Highest Capacity Atlantic Data Link 214

Email 218

Telnet and FTP 219

Cloud Computing 219

Intranets and Extranets 219

Summary 220

Self-Assessment Test 223

Review Questions 223

Discussion Questions 223

Web Exercises 223

Case One: Instant Messaging Is Easier To Secure Than Email 224

Case Two: Anatomy Of A Hack 225

Case Three: Digital Cartography Gets It Wrong 226

Notes 227

World Views Case: IT Purchase Decisions – What Should You Buy? 229

3

Business Information Systems 231



7 Operational Systems 233

Principles 233

Learning Objectives 233

Why Learn About

Operational Systems? 234

Introduction 234

Enterprise Resource Planning 235

Advantages of ERP Systems 235

Disadvantages of ERP Systems 237

ERP for Small- and Medium-Sized Enterprises (SMEs) 238

Transaction Processing Systems 238

Traditional Transaction Processing Methods and Objectives 239

Transaction Processing Activities 241

Information Systems @ Work: Fast Food

Chain Yonghe King Upgrades Their POS 244

Traditional Transaction Processing

Applications 245

Order Processing Systems 245

Purchasing Systems 247

Accounting Systems 248

Electronic and Mobile Commerce 248

Electronic Commerce 248

Mobile Commerce 251

Ethical and Societal Issues: Tracking Staff Beyond the Workplace 251

Production and Supply Chain

Management 253

Customer Relationship Management and Sales Ordering 254

Financial and Managerial Accounting 255

Hosted Software Model for Enterprise Software 256

International Issues Associated with Operational Systems 256

Different Languages and Cultures 257

Disparities in Information System Infrastructure 257

Infrastructure 257

Varying Laws and Customs Rules 257

Multiple Currencies 257

Summary 258

Self-Assessment Test 259

Review Questions 259

Discussion Questions 260

Web Exercises 260

Case One: Non-Linear Presentations 260

Case Two: When Stock Becomes a Liability 262

Case Three: Netflix Analytics Creates Content That We'll Watch 263

Notes 264

8 Management Information and Decision Support Systems 265

Principles 265

Learning Objectives 265

Why Learn About Management

Information Systems and Decision Support Systems? 266

Decision Making and Problem Solving 266

Programmed versus Non-Programmed Decisions 267

Optimization, Satisficing and Heuristic Approaches 268

<i>Sense and Respond</i> 268	
<i>Big Data</i> 269	
An Overview of Management Information Systems 269	
<i>Inputs to a Management Information System</i> 269	
<i>Outputs of a Management Information System</i> 270	
<i>Characteristics of a Management Information System</i> 273	
Functional MIS 274	
<i>Financial Management Information Systems</i> 275	
<i>Manufacturing Management Information Systems</i> 277	
<i>Marketing Management Information Systems</i> 280	
<i>Human Resource Management Information Systems</i> 282	
<i>Geographic Information Systems</i> 284	
Decision Support Systems 284	
<i>Characteristics of a Decision Support System</i> 285	
<i>Capabilities of a Decision Support System</i> 286	
<i>A Comparison of a DSS and an MIS</i> 287	
<i>Components of a Decision Support System</i> 287	
Information Systems @ Work: Non-Linear What-If Analysis in OpenOffice 288	
Group Support Systems 291	
Ethical and Societal Issues: Online Divorce Form Error 'Could Have Led to Unfair Settlements' 292	
<i>Characteristics of a GSS that Enhance Decision Making</i> 293	
Executive Support Systems 294	
<i>Capabilities of Executive Support Systems</i> 295	
Summary 296	
Self-Assessment Test 298	
Review Questions 298	
Discussion Questions 299	
Web Exercises 299	
Case One: Smart Meters Capture Big Data For Energy Decisions 299	
Case Two: Taking Designs into the Next Dimension 300	
Case Three: Computer Games as Decision Tools 301	
Notes 303	
9 Knowledge Management and Specialized Information Systems 305	
Principles 305	
Learning Objectives 305	
Why Learn About Knowledge Management and Specialized Information Systems? 306	
Knowledge Management Systems 306	
<i>Overview of Knowledge Management Systems</i> 306	
<i>Obtaining, Storing, Sharing and Using Knowledge</i> 307	
<i>Technology to Support Knowledge Management</i> 308	
Artificial Intelligence 309	
<i>The Nature of Intelligence</i> 309	
<i>The Difference Between Natural and Artificial Intelligence</i> 311	
Information Systems @ Work: Playing with Atoms 312	
<i>The Major Branches of Artificial Intelligence</i> 312	
Ethical and Societal Issues: Augmented Reality's Killer App 317	
Expert Systems 318	
<i>When to Use Expert Systems</i> 318	
<i>Components of Expert Systems</i> 319	
Virtual Reality 325	
<i>Interface Devices</i> 325	
<i>Forms of Virtual Reality</i> 326	
<i>Virtual Reality Applications</i> 326	
Summary 327	
Self-Assessment Test 328	
Review Questions 329	
Discussion Questions 329	
Web Exercises 329	
Case One: A 'Soft' Octopus Robot 329	
Case Two: 360° Video Makes Virtual Reality Accessible 331	
Case Three: Game-Show-Winning AI Now Diagnoses Rare Diseases 332	
Notes 333	
10 Pervasive Computing 335	
Principles 335	
Learning Objectives 335	
Why Learn About Pervasive Computing? 336	
Introduction 336	
Wireless Internet Access 337	
Mobile Devices 337	
<i>Smartphone</i> 338	
<i>Wearable Technology</i> 339	
Ethical and Societal Issues: Pay Up Or Your Data Gets It! 340	
Information Systems @ Work: The Blockchain Creates Tamper-Proof Transactions 342	
<i>E-Money</i> 343	
<i>Tangible Media</i> 344	

<i>Personal Robotics</i>	345
<i>Virtual Pets</i>	346
Computer Supported Cooperative Work	346
<i>Videoconferencing</i>	347
<i>Messaging</i>	347
<i>Interactive Whiteboards</i>	347
<i>Wikis</i>	348
<i>MMOGs</i>	348
<i>Blogs and Podcasts</i>	349
More Applications of Electronic and Mobile Commerce	350
<i>Retail and Wholesale</i>	350
<i>Manufacturing</i>	350
<i>Marketing</i>	352
<i>Investment and Finance</i>	353
<i>Auctions</i>	353
<i>Anywhere, Anytime Applications of Mobile Commerce</i>	353
<i>Advantages of Electronic and Mobile Commerce</i>	354
Summary	355
Self-Assessment Test	356
Review Questions	356
Discussion Questions	357
Web Exercises	357
Case One: Someone to Share a Journey With	357
Case Two: Kids Finally Get a Real Magic Wand at Disney	358
Case Three: Let's Play and Become Famous	359
Notes	360
World Views Case: Information Systems at Damelin, South Africa	362

4 Systems Development 365



11 Systems Analysis 367

Principles	367
Learning Objectives	367
Why Learn About Systems Analysis?	368
An Overview of Systems Development	368
<i>Participants in Systems Development</i>	368
<i>Information Systems Planning and Aligning Organization and IS Goals</i>	370

<i>Establishing Objectives for Systems Development</i>	372
Systems Development Lifecycles	374
<i>The Traditional Systems Development Lifecycle</i>	374
<i>Prototyping</i>	376
Information Systems @ Work: Open Source Software Conquers Data Science	378
<i>Rapid Application Development, Agile Development, Joint Application Development and Other Systems Development Approaches</i>	379
<i>The End-User Systems Development Lifecycle</i>	380
<i>Outsourcing and On-Demand Computing</i>	380
Factors Affecting System Development Success	381
<i>Involvement</i>	381
<i>Degree of Change</i>	382
<i>Managing Change</i>	382
<i>Quality and Standards</i>	383
<i>Use of Project Management Tools</i>	384
<i>Use of Computer-Aided Software Engineering (CASE) Tools</i>	386
Systems Investigation	387
<i>Initiating Systems Investigation</i>	387
<i>Participants in Systems Investigation</i>	388
<i>Feasibility Analysis</i>	388
<i>The Systems Investigation Report</i>	389
Ethical and Societal Issues: The Very Last Step in Systems Development	390
Systems Analysis	391
<i>General Considerations</i>	391
<i>Participants in Systems Analysis</i>	391
<i>Data Collection and Analysis</i>	392
<i>Requirements Analysis</i>	397
<i>Critical Success Factors</i>	397
<i>The IS Plan</i>	397
<i>Screen and Report Layout</i>	398
<i>Requirements Analysis Tools</i>	399
<i>Object-Oriented Systems Analysis</i>	399
<i>The Systems Analysis Report</i>	399
Summary	400
Self-Assessment Test	403
Review Questions	403
Discussion Questions	404
Web Exercises	404
Case One: Hackathon Culture	404
Case Two: Failover from Amazon	405
Case Three: The Internet of Bananas 1.0	406
Notes	408

12 Systems Design and Implementation 409

Principles 409

Learning Objectives 409

Why Learn About Systems Design and Implementation? 410

Systems Design 410

Interface Design and Controls 411

Design of System Security and Controls 412

Generating Systems Design Alternatives 415

Freezing Design Specifications 420

The Contract 420

The Design Report 420

Information Systems @ Work: Creating Computer Games Without Needing to Program 421

Systems Implementation 422

Acquiring Hardware from an IS Vendor 423

Acquiring Software: Make or Buy? 423

Acquiring Database and Telecommunications Systems 426

User Preparation 426

IS Personnel: Hiring and Training 426

Site Preparation 427

Data Preparation 427

Installation 427

Testing 427

Ethical and Societal Issues: Modelling a Mass Shooting 428

Start-Up 429

User Acceptance 430

Systems Operation and Maintenance 431

Reasons for Maintenance 431

Types of Maintenance 432

The Request for Maintenance Form 432

Performing Maintenance 433

The Financial Implications of Maintenance 433

The Relationship Between Maintenance and Design 433

Systems Review 434

Types of Review Procedures 434

Factors to Consider During Systems Review 435

System Performance Measurement 436

Summary 436

Self-Assessment Test 438

Review Questions 439

Discussion Questions 439

Web Exercises 439

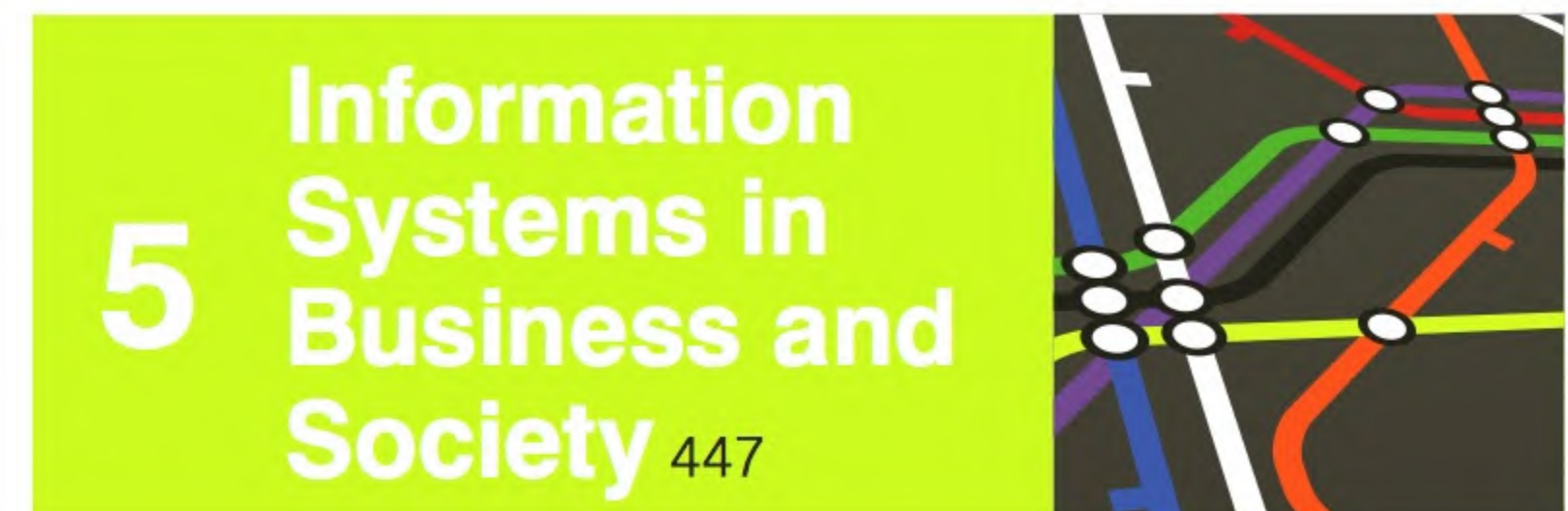
Case One: Open Source Project Aims to Create Artificial Life 440

Case Two: Build Your Own Robot 441

Case Three: GitHub 442

Notes 443

World Views Case: Systems Development at Damelin, South Africa 445



13 Security, Privacy and Ethical Issues in Information Systems 449

Principles 449

Learning Objectives 449

Why Learn About Security, Privacy and Ethical Issues in Information Systems? 450

Computer Waste and Mistakes 450

Preventing Computer-Related Waste and Mistakes 451

Information Systems @ Work: Admiral to Price Car Insurance Based on Facebook Posts 453

Computer Crime 454

Preventing Computer-Related Crime 460

Crime Prevention by the State 460

Crime Prevention by Organizations 461

Crime Prevention by Individuals 463

Using Intrusion Detection Software 463

Using Managed Security Service Providers (MSSPs) 464

Preventing Crime on the Internet 464

Privacy 465

Privacy and the Government 465

Privacy at Work 465

Email Privacy 465

Privacy and the Internet 466

Fairness in Information Use 467

Individual Efforts to Protect Privacy 468

The Work Environment 469

Health Concerns 469

Avoiding Health and Environmental Problems 470

Ethical and Societal Issues: Kettle Botnet Heats Up 471

Ethical Issues in Information Systems 472