Section One

Strategy, Products, and Capacity

1 Introduction 2
2 Strategy 20
3 Design of Products and Services 39
4 Projects 71
5 Strategic Capacity Management 108
5S Investment Analysis 128
6 Learning Curves 144

Section Two

Manufacturing and Service Processes

7 Manufacturing Processes 162
7S Manufacturing Technology 182
8 Facility Layout 189
9 Service Processes 223
9S Health Care 244
10 Waiting Line Analysis and Simulation 258
11 Process Design and Analysis 301
11S Operations Consulting 334
12 Six Sigma Quality 344
13 Statistical Quality Control 363

Section Three

Supply Chain Processes

14 Lean Supply Chains 396
15 Logistics, Distribution, and Transportation 424
16 Global Sourcing and Procurement 448

Section Four

Supply and Demand Planning and Control

17 The Internet of Things and ERP 472
18 Forecasting 485
19 Sales and Operations Planning 526
19S Linear Programming Using the Excel Solver 552
20 Inventory Management 566
21 Material Requirements Planning 609
22 Workcenter Scheduling 640
22S Theory of Constraints 672

Appendices

A Interest Tables 703
B Negative Exponential Distribution: Values of $e^{-X}$ 707
C Areas of the Cumulative Standard Normal Distribution 708
D Uniformly Distributed Random Digits 709
E Answers to Selected Objective Questions 710

Index 712
Section One

STRATEGY, PRODUCTS, AND CAPACITY

1 INTRODUCTION 2
Introduction—The Elements of OSCM  3
What Is Operations and Supply Chain Management? 4
Distinguishing Operations versus Supply Chain Processes 4
Categorizing Operations and Supply Chain Processes 6
Differences between Services and Goods 7
The Goods—Services Continuum 8
Product—Service Bundling 9
Careers in OSCM 9
The Major Concepts that Define the OSCM Field 10
Current Issues in Operations and Supply Chain Management 13
Efficiency, Effectiveness, and Value 13
Concept Connections 14
Discussion Questions 15
Objective Questions 16
Analytics Exercise: Comparing Companies Using Wall Street Efficiency Measures 16
Practice Exam 19

2 STRATEGY 20
What Is Operations and Supply Chain Strategy? 21
Competitive Dimensions 22
The Notion of Trade-Offs 24
Order Winners and Order Qualifiers: The Marketing—Operations Link 24
Strategies Are Implemented Using Operations and Supply Chain Activities—IKEA'S Strategy 25
Assessing the Risk Associated with Operations and Supply Chain Strategies 25
Risk Management Framework 27
Productivity Measurement 28

A Sustainable Operations and Supply Chain Strategy 30
Concept Connections 31
Solved Problem 33
Discussion Questions 33
Objective Questions 34
Case: The Tao of Timbuk2 36
Practice Exam 37

3 DESIGN OF PRODUCTS AND SERVICES 39
Product Design 40
Product Development Process 41
Product Design Criteria 46
Designing for the Customer 47
Value Analysis/Value Engineering 48
Designing Products for Manufacture and Assembly 49
Designing Service Products 53
Economic Analysis of Product Development Projects 54
Build a Base-Case Financial Model 55
Sensitivity Analysis to Understand Project Trade-Offs 57
Measuring Product Development Performance 58
Concept Connections 59
Solved Problem 60
Discussion Questions 63
Objective Questions 63
Case: IKEA: Design and Pricing 66
Case: Comparison of Competing Products 68
Practice Exam 70

4 PROJECTS 71
What Is Project Management? 72
Organizing the Project Team 73
Pure Project 73
Functional Project 73
Matrix Project 74
Organizing Project Tasks 75
Managing Projects 76
Earned Value Management (EVM) 78
Network-Planning Models 81
Critical Path Method (CPM) 82
Section Two

MANUFACTURING AND SERVICE PROCESSES

7 MANUFACTURING PROCESSES 162
What Are Manufacturing Processes? 163
How Manufacturing Processes Are Organized 165
Break-Even Analysis 167
Manufacturing Process Flow Design 169
Concept Connections 174
Solved Problems 175
Discussion Questions 176
Objective Questions 177
Case: Circuit Board Fabricators, Inc. 179
Practice Exam 181

7S MANUFACTURING TECHNOLOGY 182
Technologies in Manufacturing 182
Computer-Integrated Manufacturing 185
Concept Connections 187
Discussion Questions 188

8 FACILITY LAYOUT 189
Analyzing the Four Most Common Layout Formats 191
Workcenters (Job Shops) 191
Systematic Layout Planning 195
Assembly Lines 195
Assembly-Line Design 195
Splitting Tasks 199
Flexible and U-Shaped Line Layouts 200
Mixed-Model Line Balancing 200
Cells 202
Project Layouts 202
Retail Service Layout 204
Servicenodes 204
Signs, Symbols, and Artifacts 206
Office Layout 206
Concept Connections 207
Solved Problems 208
Discussion Questions 213
Objective Questions 213
Advanced Problems 219
Analytics Exercise: Designing a Manufacturing Process 220
Practice Exam 222
9 SERVICE PROCESSES 223
The Nature of Services 224
  An Operational Classification of Services 225
Designing Service Organizations 225
  Structuring the Service Encounter: The Service-System Design Matrix 227
Web Platform Businesses 228
Managing Customer-Introduced Variability 230
Applying Behavioral Science to Service Encounters 230
Service Blueprinting and Fail-Safing 233
Three Contrasting Service Designs 234
  The Production-Line Approach 235
  The Self-Service Approach 236
  The Personal-Attention Approach 236
Seven Characteristics of a Well-Designed Service System 237
Concept Connections 239
Discussion Questions 240
Objective Questions 241
Case: South Beach Pizza: An Exercise in Translating Customer Requirements into Process Design Requirements 241
Practice Exam 243

9S HEALTH CARE 244
The Nature of Health Care Operations 244
  Classification of Hospitals 245
  Hospital Layout and Care Chains 246
  Capacity Planning 247
  Workforce Scheduling 248
  Quality Management and Process Improvement 248
  Health Care Supply Chains 249
  Inventory Management 250
  Performance Measures 251
  Performance Dashboards 252
Trends in Health Care 252
Concept Connections 254
Discussion Questions 254
Objective Questions 255
Case: Managing Patient Wait Times at a Family Clinic 255
Practice Exam 257

10 WAITING LINE ANALYSIS AND SIMULATION 258
The Waiting Line Problem 259
  The Practical View of Waiting Lines 259
  The Queuing System 260
Waiting Line Models 267
  Approximating Customer Waiting Time 273
Simulating Waiting Lines 276
  Example: A Two-Stage Assembly Line 276
  Spreadsheet Simulation 279
  Simulation Programs and Languages 282
Concept Connections 283
Solved Problems 285
Discussion Questions 288
Objective Questions 288
Case: Community Hospital Evening Operating Room 293
Analytics Exercise: Processing Customer Orders 293
Practice Exam 296

11 PROCESS DESIGN AND ANALYSIS 301
Process Analysis 302
  Example—Analyzing a Las Vegas Slot Machine 302
  Process Flowcharting 304
Understanding Processes 305
  Buffering, Blocking, and Starving 305
  Make-to-Stock vs. Make-to-Order 306
  Measuring Process Performance 309
  Production Process Mapping and Little’s Law 311
Job Design Decisions 313
  Behavioral Considerations in Job Design 314
  Work Measurement and Standards 314
Process Analysis Examples 315
  A Bread-Making Operation 315
  A Restaurant Operation 316
  Planning a Transit Bus Operation 318
  Process Flow Time Reduction 320
Concept Connections 322
Solved Problems 324
Discussion Questions 326
Objective Questions 327
Case: Runners Edge—Call Center Process Analysis 331
Practice Exam 333

11S OPERATIONS CONSULTING 334
What is Operations Consulting? 334
  The Management Consulting Industry 334
Economics of Consulting Firms 335
When Operations Consulting is Needed 336
The Operations Consulting Process 337
  Operations Consulting Tool Kit 338
  Problem Definition Tools 338
  Data Gathering 340
  Data Analysis and Solution Development 341
  Cost Impact and Payoff Analysis 341
  Implementation 342
Concept Connections 342
Discussion Questions 343
Objective Questions 343
Practice Exam 343

12 SIX SIGMA QUALITY 344
Total Quality Management 345
  Quality Specifications and Quality Costs 346
  Developing Quality Specifications 346
Cost of Quality 347
Six Sigma Quality 349
  Six Sigma Methodology 350
  Analytical Tools for Six Sigma 351
  Six Sigma Roles and Responsibilities 354
  The Shingo System: Fail-Safe Design 355
ISO 9000 and ISO 14000 356
13 Statistical Quality Control 363

Section Three

Supply Chain Processes

14 Lean Supply Chains 396

15 Logistics, Distribution, and Transportation 424

16 Global Sourcing and Procurement 448
How Supply Chain Planning and Control Fits Within ERP 479
  Simplified Example 479
  SAP Supply Chain Management 479
  SAP Supply Chain Execution 480
  SAP Supply Chain Collaboration 480
  SAP Supply Chain Coordination 481
Performance Metrics to Evaluate
Integrated System Effectiveness 481
  The "Functional Silo" Approach 482
Concept Connections 483
Discussion Questions 484
Objective Questions 484
Practice Exam 484

18 Forecasting 485
Forecasting in Operations and Supply Chain Management 486
Quantitative Forecasting Models 487
  Components of Demand 487
  Time Series Analysis 488
  Forecast Errors 501
  Causal Relationship Forecasting 504
Qualitative Techniques in Forecasting 506
  Market Research 507
  Panel Consensus 507
  Historical Analogy 507
  Delphi Method 507
Web-Based Forecasting: Collaborative Planning, Forecasting, and Replenishment (CPFR) 508
Concept Connections 509
Solved Problems 511
Discussion Questions 515
Objective Questions 516
Analytics Exercise: Forecasting Supply Chain Demand—Starbucks Corporation (LO18-2) 524
Practice Exam 525

19 Sales and Operations Planning 526
What Is Sales and Operations Planning? 527
  An Overview of Sales and Operations Planning Activities 527
  The Aggregate Operations Plan 529
Aggregate Planning Techniques 533
  A Cut-and-Try Example: The JC Company 533
  Aggregate Planning Applied to Services: Tucson Parks and Recreation Department 538
Yield Management 540
  Operating Yield Management Systems 541
Concept Connections 542
Solved Problem 543
Discussion Questions 546
Objective Questions 546
Analytics Exercise: Developing an Aggregate Plan—Bradford Manufacturing 549
Practice Exam 550

19S Linear Programming Using the Excel Solver 552
The Linear Programming Model 553
Linear Programming Using Microsoft Excel 554
Concept Connections 557
Solved Problem 557
Objective Questions 564

20 Inventory Management 566
Understanding Inventory Management 567
  Purposes of Inventory 569
  Inventory Costs 570
  Independent versus Dependent Demand 570
Inventory Control Systems 571
  A Single-Period Inventory Model 572
  Multi-Period Inventory Systems 573
  Fixed-Order Quantity Models 576
  Fixed-Period Models 582
  Inventory Turn Calculation 584
  Price-Break Model 585
Inventory Planning and Accuracy 588
  ABC Classification 588
  Inventory Accuracy and Cycle Counting 589
Concept Connections 591
Solved Problems 593
Discussion Questions 596
Objective Questions 596
Analytics Exercise: Inventory Management at Big10Sweaters.com 605
Practice Exam 607

21 Material Requirements Planning 609
Understanding Material Requirements Planning 610
  Where MRP Can Be Used 610
  Master Production Scheduling 610
Material Requirements Planning System Structure 613
  Demand for Products 613
  Bill-of-Materials 614
  Inventory Records 616
  MRP Computer Program 617
An Example Using MRP 618
  Forecasting Demand 618
  Developing a Master Production Schedule 618
  Bill-of-Materials (Product Structure) 619
  Inventory Records 619
  Performing the MRP Calculations 619
Lot Sizing in MRP Systems 622
Lot-for-Lot 623
Economic Order Quantity 623
Least Total Cost 624
Least Unit Cost 625
Choosing the Best Lot Size 625
Concept Connections 626
Solved Problems 628
Discussion Questions 633
Objective Questions 633
Analytics Exercise: An MRP Explosion—Brunswick Motors 637
Practice Exam 639

22 WORKCENTER SCHEDULING 640
Workcenter Scheduling 641
The Nature and Importance of Workcenters 641
Typical Scheduling and Control Functions 643
Objectives of Workcenter Scheduling 644
Job Sequencing 644
Priority Rules and Techniques 645
Scheduling n Jobs on One Machine 645
Scheduling n Jobs on Two Machines 648
Scheduling a Set Number of Jobs on the Same Number of Machines 649
Scheduling n Jobs on m Machines 651
Shop-Floor Control 651
Gantt Charts 651
Tools of Shop-Floor Control 652
Principles of Workcenter Scheduling 654
Personnel Scheduling in Services 655
Scheduling Daily Work Times 655
Scheduling Hourly Work Times 656
Concept Connections 657
Solved Problems 659
Discussion Questions 664
Objective Questions 664
Case: Keep Patients Waiting? Not in My Office 669
Practice Exam 671

22S THEORY OF CONSTRAINTS 672
Eli Goldratt's Theory of Constraints 672
The Goal of the Firm 673
Performance Measurements 673
Unbalanced Capacity 675
Bottlenecks, Capacity-Constrained Resources, and Synchronous Manufacturing 676
Basic Manufacturing Building Blocks 677
Methods for Synchronous Control 677
Comparing Synchronous Manufacturing (TOC) to Traditional Approaches 686
MRP and JIT 686
Relationship with Other Functional Areas 687
Theory of Constraints—Problems About What to Produce 688
Concept Connections 695
Solved Problem 696
Discussion Questions 698
Objective Questions 698
Practice Exam 702

APPENDICES

A Interest Tables 703

B Negative Exponential Distribution: Values of $e^{-x}$ 707

C Areas of the Cumulative Standard Normal Distribution 708

D Uniformly Distributed Random Digits 709

E Answers to Selected Objective Questions 710

INDEX 712