

QUANTITATIVE APPROACHES TO MANAGEMENT

SIXTH EDITION

RICHARD I. LEVIN, Ph.D.
DAVID S. RUBIN, Ph.D.

School of Business Administration
University of North Carolina at Chapel Hill

JOEL P. STINSON, Ph.D.

School of Management
Syracuse University

TECHNISCHE HOCHSCHULE DARMSTADT	
Fachbereich 1	
<u>Gesamtbibliothek</u>	
<u>Betriebswirtschaftslehre</u>	
Inventar-Nr. :	38.101
Abstell-Nr. :	A 14/1144
Sachgebiete :	1.6.0

McGRAW-HILL BOOK COMPANY

New York St. Louis San Francisco Auckland Bogotá Hamburg
Johannesburg London Madrid Mexico Montreal New Delhi Panama
Paris São Paulo Singapore Sydney Tokyo Toronto

CONTENTS

Preface

CHAPTER 1

INTRODUCTION

	3
1. Management science/operations research: The quantitative approach to management decision making	5
2. The development of scientific management: From industrial engineering to management science/operations research	9
3. Early management science/operations research	11
4. Management science/operations research today	16
5. Relationship between the quantitative specialist and the manager	16
6. Typical applications of management science/operations research	17
7. Quantitative methods to be discussed	23
8. Management information systems	25
9. The relationship between management information systems and management science/operations research: An historical perspective	32
10. Microcomputers and MS/OR	33
11. Glossary	34
12. Exercises	35
13. Chapter concepts quiz	36

CHAPTER 2	
A REVIEW OF PROBABILITY CONCEPTS	41
1. Introduction	42
2. Basic probability concepts	42
3. Three types of probability	43
4. Probability rules	45
5. Probabilities under conditions of statistical independence	49
6. Probabilities under conditions of statistical dependence	55
7. Revising prior estimates of probabilities: Bayes' theorem	61
8. The concept of probability distributions	64
9. Random variables	68
10. The binomial distribution	71
11. The Poisson distribution	77
12. The exponential distribution	79
13. The normal distribution	82
14. Glossary	94
15. Review of equations	95
16. Exercises	98
17. Chapter concepts quiz	104
CHAPTER 3	
FORECASTING	107
1. Introduction	107
2. Judgmental forecasting	109
3. Time-series patterns	111
4. Evaluating forecast accuracy	111
5. Moving averages	114
6. Simple exponential smoothing	116
7. Time-series regression	120
8. The exponential smoothing of linear trends	123
9. The decomposition of seasonal data	128
10. Glossary	134

11. Review of equations	136
12. Exercises	137
13. Chapter concepts quiz	142

CHAPTER 4

DECISION MAKING USING PROBABILITIES I	145
1. Introduction to decision making	146
2. Steps in decision making	146
3. The different environments in which decisions are made	147
4. The criteria for decision making under uncertainty	148
5. Decision making under conditions of risk: Discrete random variables	151
6. Using the expected value criterion with continuously distributed random variables	169
7. Supplying the numbers	170
8. Combining experience and numbers	173
9. Utility as a decision criterion	175
10. Glossary	180
11. Review of equations	182
12. Exercises	182
13. Chapter concepts quiz	192

CHAPTER 5

DECISION MAKING USING PROBABILITIES II	195
1. The normal probability distribution and cost-volume-profit analysis	196
2. Combining unit monetary values and probability distributions	199
3. Replacement analysis: Items which fail over time	206
4. Decision trees: Graphic displays of the decision-making process	208
5. Decision making with an active opponent	219
6. Glossary	230
7. Review of equations	231
8. Exercises	231
9. Chapter concepts quiz	238

CHAPTER 6	
INVENTORY I	243
1. What functions does inventory perform	244
2. Inventory decisions	245
3. Selective approach to managing inventory (ABC analysis)	245
4. <i>Economic order quantity: The basic “how much to buy” model</i>	246
5. How to eliminate the instantaneous receipt assumption in EOQ models	255
6. Using EOQ models when annual demand cannot be forecast	257
7. Using EOQ models when cost information is not available	259
8. Applying the EOQ model to production processes	265
9. Some conclusions about EOQ models	269
10. Glossary	271
11. Review of equations	271
12. Exercises	273
13. Chapter concepts quiz	279
CHAPTER 7	
INVENTORY II	283
1. Deciding when to buy: Introduction	284
2. How to determine the optimum level of safety stock when out-of-stock costs are known	286
3. Setting safety stock levels when out-of-stock costs are not known	289
4. Joint ordering: More than one SKU from the same supplier simultaneously	295
5. Reordering with planned stockouts	298
6. How to evaluate quantity discounts offered by suppliers	304
7. Material requirements planning (MRP)	308
8. Glossary	312
9. Review of equations	313
10. Exercises	314
11. Chapter concepts quiz	323

CHAPTER 8	
LINEAR PROGRAMMING I:	
GRAPHIC METHODS	327
1. Introduction	327
2. Graphic solution to a maximization problem	329
3. Some technical issues in linear programming	341
4. Graphic solution to a minimization problem	346
5. Glossary	352
6. Review of equations	352
7. Exercises	353
8. Chapter concepts quiz	358
CHAPTER 9	
LINEAR PROGRAMMING II:	
THE SIMPLEX METHOD	363
1. Setting up the initial solution	364
2. Developing the second solution	370
3. Developing the third solution	374
4. Justification and significance of all elements in the simplex tableau	378
5. The simplex solution to a minimizing problem	384
6. Glossary	394
7. Exercises	394
8. Chapter concepts quiz	402
CHAPTER 10	
LINEAR PROGRAMMING III:	
ECONOMIC AND OPERATIONAL ISSUES	407
1. The dual in linear programming	408
2. Some technical issues in the simplex method	413
3. Objectives other than maximizing contribution	416
4. Sensitivity analysis	417
5. Linear programming applications	420

6. Use of the computer in linear programming	428
7. Sensitivity analysis and the computer	432
8. Glossary	436
9. Exercises	437
10. Chapter concepts quiz	447

CHAPTER 11
NETWORKS I **451**

1. The transportation problem (demand equals supply)	452
2. The transportation problem (demand does not equal supply)	477
3. Degeneracy	481
4. The assignment problem	484
5. Using the computer to solve assignment and transportation problems	492
6. Glossary	492
7. Review of equations	494
8. Exercises	495
9. Chapter concepts quiz	504

CHAPTER 12
NETWORKS II **509**

1. PERT (program evaluation and review technique)	510
2. CPM (critical path method)	528
3. PERT/Cost	534
4. Network scheduling with resource limitations	536
5. The maximal-flow problem	541
6. The minimal spanning tree problem	545
7. The shortest-route problem	547
8. Dynamic programming	551
9. Glossary	557
10. Review of equations	559
11. Exercises	560
12. Chapter concepts quiz	572

CHAPTER 13	
INTEGER PROGRAMMING, BRANCH-AND-BOUND METHOD, GOAL PROGRAMMING, HEURISTICS	577
1. Integer programming	578
2. Branch-and-bound method	582
3. Goal programming	587
4. Heuristics	593
5. Glossary	603
6. Exercises	603
7. Chapter concepts quiz	609
CHAPTER 14	
SIMULATION	613
1. Introduction	613
2. Simulation in practice	616
3. A hand-computed simulation	620
4. Computer simulation	624
5. Using heuristics in simulation	633
6. Glossary	636
7. Exercises	637
8. Chapter concepts quiz	645
CHAPTER 15	
WAITING LINES	649
1. Introductory queuing ideas	650
2. Queuing objectives and cost behavior	653
3. Standard language and definitions for waiting lines	654
4. Elementary queuing system: Constant arrival and service times	658
5. Single-channel queuing model: Poisson-distributed arrivals and exponentially distributed service times	659
6. Single-channel queuing model: Poisson-distributed arrivals and any-service-time distribution	661

7. Single-channel queuing model: Poisson-distributed arrivals, exponentially distributed service times, and finite waiting capacity	663
8. Multiple-channel queuing model: Poisson-distributed arrivals and exponentially distributed service times	666
9. The limitations of queuing theory	668
10. Simulation of a queuing system	669
11. Comparing the simulation solution with a formula solution	677
12. Glossary	678
13. Review of equations	679
14. Exercises	681
15. Chapter concepts quiz	687

CHAPTER 16
MARKOV ANALYSIS **691**

1. Introduction to brand-switching analysis	692
2. A matrix algebra primer	694
3. Prediction of market shares for future periods	700
4. Equilibrium conditions	706
5. Use of Markov analysis in marketing strategy	712
6. Other uses of Markov analysis	714
7. Glossary	720
8. Exercises	721
9. Chapter concepts quiz	728

CHAPTER 17
MANAGEMENT SCIENCE: YESTERDAY, TODAY, AND TOMORROW **733**

1. Three phases of growth	733
2. Extent of use of quantitative methods in organizations	735
3. Some problems in the use of quantitative methods to supply answers	738
4. Improving the long-run success of quantitative methods—Alternative views	742
5. The future of quantitative methods	746

APPENDIXES	1	The Standard Normal Probability Distribution	750
	2	The Cumulative Binomial Distribution	752
	3	Unit Normal Loss Integral	765
	4	Value of $e^{-\lambda}$ for Computing Poisson Probabilities	767
	5	Values of P_0	768
	6	Random Numbers Table (2500 random digits)	770
	7	Derivation of EOQ Formulas	772
	8	Functional List of Text Exercises	774
BIBLIOGRAPHY			779
		Answers to the Chapter Concepts Quizzes	783
		Index	787