CONTENTS

Preface ix

1. Introduction

Why This Book? 1
Conducting a Systems Analysis 2
Where to from Here? 16
References 17

2. Probability Theory and Transform Methods

Probability Theory 18
Transform Methods 50
Summary 78
References 78
Problems 78

3. Poisson Queues

Introduction 85
Infinite Population Models: $(M \mid M \mid c) : (GD \mid N \mid \infty)$ Queue 89
Finite Population Models: $(M \mid M \mid c) : (GD \mid K \mid K)$ Queue 113
Bulk Arrivals: $(M^{(b)} \mid M \mid c) : (GD \mid \infty \mid \infty)$ Queue 120
Network of Poisson Queues 124
Summary 133
References 134
Problems 134

4. Non-Poisson Queues

Introduction 143
Pollaczek–Khintchine Formula 144
Method of Stages 150
Numerical Solution of Steady-State Balance Equations 174
Summary 177
References 178
Problems 178

5. Decision Models

Introduction 182
Classical Optimization 184
Search Techniques 193
Cost Models 207
Aspiration Level Models 226
Cost Determination 231
Summary 238
References 239
Problems 240

6. Transient Analysis and Special Topics

Introduction 245
$(M \mid G \mid 1) : (GD \mid \infty \mid \infty)$ Queue 246
Busy Period 252
$(GI \mid M \mid 1) : (GD \mid \infty \mid \infty)$ Queue 255
Priority Service Disciplines 257
Transient Analysis 265
$(M \mid M \mid \infty) : (GD \mid \infty \mid \infty)$ Queue 272
Summary 291
References 292
Problems 292

7. Data Analysis—Estimation

Introduction 297
Identifying the Distribution 298
Point Estimation 302
Goodness-of-Fit Tests 330
Interval Estimation 344
Summary 355
References 355
Problems 355

8. Data Analysis—Hypothesis Testing

Introduction 360
Null and Alternative Hypotheses 361
Type I and Type II Errors 361
Sample Size 362
Tests for a Single Parameter 363
Tests for the Comparison of Two Parameters 380
Effects of Nonnormality 393
Other Statistical Tests 394
Charting Techniques 395
Summary 409
References 409
Problems 410

9. Simulation of Queueing Systems

Introduction 414
Simulation Modeling 415
Monte Carlo Method 418
Generation of Uniformly Distributed Random Numbers 421
Process Generation of Continuous Random Variables with Known Density Functions 422
Process Generators for Discrete Random Variables with Known Probability Mass Functions 426
Empirical Process Generators 428
Simulation of a Single-Channel Queueing System $(G \mid G \mid 1) : (FCFS \mid \infty \mid \infty)$ 435
Multiple Channels in Parallel $(G \mid G \mid C) : (FCFS \mid \infty \mid \infty)$ 450
Simulation of Networks of Queues 490
Summary 506
References 506
Problems 506

Appendix. Tables 515

Index 529