

# Table of Contents

Preface v

Contributors

Ch. 1. Transformation of Western Style of Management 1

*W. Edwards Deming*

1. The crisis of Western industry 1
2. A declining market exposes weaknesses 1
3. Forces that feed the decline 2
4. Remarks on evaluation of performance, or the so-called merit rating 3
5. Modern principles of leadership 3
6. Other obstacles 4
7. Remarks on use of visible figures 4
8. Condensation of the 14 points for management 5
9. What is required for change? 6

Ch. 2. Software Reliability 7

*F. B. Bastani and C. V. Ramamoorthy*

1. Introduction 7
2. Definition and classification 8
3. Software reliability growth models 12
4. Sampling models 20
5. Conclusion 23
- References 24

Ch. 3. Stress–Strength Models for Reliability 27

*R. A. Johnson*

1. Introduction 27
2. Nonparametric inference about stress–strength reliability 28
3. Parametric inference produces 32
4. Stress–strength models for system reliability 38

- 5. Extensions of the basic stress–strength models 45
- 6. Bayesian inference procedures 48
  - References 53

#### Ch. 4. Approximate Computation of Power Generating System Reliability Indexes 55

*M. Mazumdar*

- 1. Introduction 55
- 2. Generating system model and the reliability indexes 57
- 3. Approximate procedures 62
- 4. Numerical results 66
  - Summary and conclusion 71
  - References 72

#### Ch. 5. Software Reliability Models 73

*T. A. Mazzuchi and N. D. Singpurwalla*

- 1. Introduction 73
- 2. Models of the testing and debugging phase 74
- 3. Models of the validation phase 93
- 4. Models of the operational phase 94
- 5. Closing comments 95
  - References 96

#### Ch. 6. Dependence Notions in Reliability Theory 99

*N. R. Chaganty and K. Joag-dev*

- 1. Introduction 99
  - Part I 99
  - Part II 104
  - References 110

#### Ch. 7. Application of Goodness-of-Fit Tests in Reliability 113

*B. W. Woodruff and A. H. Moore*

- 1. Introduction 113
- 2.  $\chi^2$  goodness-of-fit tests 113
- 3. Graphical techniques 114
- 4. Modified goodness-of-fit test 115
- 5. Modifications of the EDF 118
- 6. New modified goodness-of-fit tests 119
- 7. Likelihood ratio tests 119
  - References 119

## Ch. 8. Multivariate Nonparametric Classes in Reliability 121

*H. W. Block and T. H. Savits*

- 1. Introduction 121
- 2. Multivariate nonparametric classes 122
- References 128

## Ch. 9. Selection and Ranking Procedures in Reliability Models 131

*S. S. Gupta and S. Panchapakesan*

- 1. Introduction 131
- 2. Selection and ranking procedures 132
- 3. Selection from nonparametric families 135
- 4. Nonparametric and distribution-free procedures 142
- 5. Selection from restricted families of distributions 146
- 6. Comparison with a standard or control 152
- 7. Concluding remarks 153
- References 153

## Ch. 10. The Impact of Reliability Theory on Some Branches of Mathematics and Statistics 157

*P. J. Boland and F. Proschan*

- 0. Introduction 157
- 1. Total positivity and Polya frequency functions 157
- 2. Association of random variables 161
- 3. Renewal theory 165
- 4. Majorization and Schur functions 169
- References 173

## Ch. 11. Reliability Ideas and Applications in Economics and Social Sciences 175

*M. C. Bhattacharjee*

- 0. Introduction and summary 175
- 1. The 'Impossibility Theorem' of Arrow 176
- 2. Voting games and political power 184
- 3. 'Inequality' of distribution of wealth 198
- 4. R & D rivalry and the economics of innovation 205
- References 212

## Ch. 12. Mean Residual Life: Theory and Applications 215

*F. Guess and F. Proschan*

- 1. Introduction and summary 215
- 2. Theory of mean residual life 216

- 3. Applications of mean residual life 220
  - Acknowledgements 223
  - References 223

### Ch. 13. Life Distribution Models and Incomplete Data 225

*R. E. Barlow and F. Proschan*

- 0. Introduction 225
- 1. Likelihood 225
- 2. Parameter estimators and credible intervals 235
- 3. The Weibull distribution 241
- 4. Notes and references 246
  - Acknowledgements 249
  - References 249

### Ch. 14. Piecewise Geometric Estimation of a Survival Function 251

*G. M. Mimmack and F. Proschan*

- 1. Introduction and summary 251
- 2. Preliminaries 253
- 3. Asymptotic properties of the PEGE 259
- 4. The PEGE compared with rivals 268
- 5. Small sample properties of the PEGE 273
  - References 279

### Ch. 15. Applications of Pattern Recognition in Failure Diagnosis and Quality Control 281

*L. F. Pau*

- 1. Introduction 281
- 2. Basic concepts in technical diagnostics 283
- 3. Sensors and diagnostic information 286
- 4. Diagnostic processes 292
- 5. Example: Correspondence analysis and its application 299
  - References 309

### Ch. 16. Nonparametric Estimation of Density and Hazard Rate Functions when Samples are Censored 313

*W. J. Padgett*

- 1. Introduction 313
- 2. Notation and preliminaries 314
- 3. Histogram and kernel estimators 315
- 4. Likelihood methods 321

- 5. Some other methods 325
- 6. Numerical examples of some kernel density estimators 326
- References 329

## Ch. 17. Multivariate Process Control 333

*F. B. Alt and N. D. Smith*

- Introduction 333
- Phase I control charts 335
- Phase II control charts 344
- Other approaches 350
- References 351

## Ch. 18. QMP/USP—A Modern Approach to Statistical Quality Auditing 353

*B. Hoadley*

- 1. Introduction and summary 353
- 2. USP details 360
- 3. QMP details 363
- Appendix 370
- References 372

## Ch. 19. Review About Estimation of Change Points 375

*P. R. Krishnaiah and B. Q. Miao*

- 1. Introduction 375
- 2. The estimate of the intersection of regression curves 378
- 3. Non-Bayesian estimates of change points in jump change model 383
- 4. Bayesian estimate 388
- 5. Large sample properties of the estimates of change points 391
- References 398

## Ch. 20. Nonparametric Methods for Changepoint Problems 403

*M. Csörgő and L. Horváth*

- 1. Introduction 403
- 2. Non-sequential nonparametric AMOC procedures 404
- 3. Sequential detection of change in a random sequence 419
- References 423

## Ch. 21. Optimal Allocation of Multistate Components 427

*E. El-Newehi, F. Proschan and J. Sethuraman*

- 1. Introduction 427
- 2. Optimum allocation of multistate components 428

- 3. Applications in reliability 430
- References 432

## Ch. 22. Weibull, Log-Weibull and Gamma Order Statistics 433

*H. L. Harter*

- 1. Introduction 433
- 2. Weibull order statistics 437
- 3. Log-Weibull order statistics 445
- 4. Gamma order statistics 453
- 5. Applications 460
- References 461

## Ch. 23. Multivariate Exponential Distributions and their Applications in Reliability 467

*A. P. Basu*

- 1. Introduction 467
- 2. Bivariate exponential distributions 468
- 3. Multivariate exponential distributions 472
- 4. Inference problems 473
- References 475

## Ch. 24. Recent Developments in the Inverse Gaussian Distribution 479

*S. Iyengar and G. Patwardhan*

- 1. Introduction 479
- 2. Notation and preliminaries 479
- 3. Regression 480
- 4. Multivariate theory 484
- 5. Results for the univariate inverse Gaussian 486
- 6. Extension 487
- 7. Applications 487
- 8. Conclusion 488
- Acknowledgements 489
- References 489

Subject Index 491

Contents of Previous Volumes 497