# Contents

### **1** INTRODUCTION

1.1 Origin of the Problem, 1

- 1.2 Slippage Tests, 3
- 1.3 Multiple Decision (Selection and Ranking) Procedures, 4
- 1.4 The Indifference Zone Formulation, 7
- 1.5 Subset Selection Formulation, 10
- 1.6 Some General Remarks, 12
- 1.7 On the Chapters to Follow, 13
- 1.8 Bibliography and Other References, 15

## PART I: INDIFFERENCE ZONE FORMULATION

2 RANKING OF NORMAL POPULATIONS

19

- 2.1 Ranking in Terms of the Means, 20
  - 2.1.1 A Single-Stage Ranking Procedure: Known Variances, 20
  - 2.1.2 Two-Stage Ranking Procedures: Unknown Variances, 22
  - 2.1.3 Two-Stage Selection Procedures: Common Known Variance, 25
- 2.2 Ranking in Terms of the Variances, 28
- 2.3 Ranking in Terms of the Absolute Values of the Means, 29
- 2.4 Ranking of Normal Means under r-Way Classification without Interaction, 30
- 2.5 Ranking Multiply Classified Variances of Normal Populations, 32

- 2.6 Selecting the Largest Interaction in a Two-Factor Experiment, 35
- 2.7 Δ-Correct Ranking and Some Remarks on the Ranking Procedures for the Normal Means, 39
- 2.8 Notes and Remarks, 41
- 3 Some Optimum Properties of Fixed Subset Size Selection Rules
  - 3.1 Most Economical Character of Rules, 42
  - 3.2 Uniformly Best Impartial Rule, 44
  - 3.3 Bayes, Minimax, and Admissibility Properties, 49
  - 3.4 Consistency of Single-Stage Ranking Procedures, 53
  - 3.5 Asymptotically Optimal Procedures, 56
  - 3.6 Notes and Remarks, 58
- 4 RANKING AND SELECTION PROBLEMS FOR DISCRETE DISTRIBUTIONS

59

42

- 4.1 Several Binomial Distributions: Fixed Sample Size Procedure, 60
- 4.2 Several Binomial Populations: A Multistage Procedure, 62
- 4.3 Two Binomial Populations: Play-the-Winner and Vector-at-a-Time Sampling, 64
  - 4.3.1 Rules with Termination Based on  $|S_1 S_2|$ , 65
  - 4.3.2 Rules with Termination Based on Inverse Sampling, 69
  - 4.3.3 Rules with Fixed Total Sample Size, 72
  - 4.3.4 A Truncated Procedure with VT Sampling, 73
- 4.4 Three or More Binomial Distributions: Inverse Stopping Rules with Play-the-Winner and Vector-at-a-Time Sampling, 75

### 4.5 Sequential Procedures Based on Likelihood Ratios, 76

- 4.5.1 Procedures with PW and VT Sampling, 77
- 4.5.2 Two Binomial Populations Case with Two Formulations, 79
- 4.6 Eliminating-Type Sequential Procedures, 81
- 4.7 Selecting the Coin with the Largest Bias, 84
- 4.8 Poisson Populations, 85

х

4.9 Selection of the Best Multinomial Cell, 88

4.9.1	Most	Probable	Cell,	88
4.9.2	Least	Probable	Cell,	92

- 4.10 Notes and Remarks, 93
- 5 Selection from Univariate Populations, Optimum Sampling, and Estimation of Probability of Correct Selection
  - 5.1 Selection from Finite Populations and Univariate Continuous Populations, 95
    - 5.1.1 A Two-Stage Subsampling Procedure for Ranking Means of Finite Populations, 95
    - 5.1.2 Selection from Exponential Populations, 97
  - 5.2 Some Problems of Optimum Sampling, 98
    - 5.2.1 Selection of the Population with the Largest Mean, 99
    - 5.2.2 Selection of the Gamma Population with the Largest (Smallest) Scale Parameter, 102
    - 5.2.3 Optimal Sampling Using Γ-Minimax Criterion, 103
  - 5.3 Estimation of the Probability of Correct Selection, 104
    - 5.3.1 Point Estimation: Location Parameter Case, 105
    - 5.3.2 Point Estimation: Scale Parameter Case, 107
    - 5.3.3 Interval Estimation, 108
  - 5.4 Notes and Remarks, 108
- 6 SEQUENTIAL SELECTION PROCEDURES
  - 6.1 Introduction, 109
  - 6.2 Selection of the Largest Normal Mean, 109
  - 6.3 Asymptotically Nonparametric Procedures for Selecting the Largest Mean, 116
  - 6.4 Selection of the Largest Center of Symmetry, 119
  - 6.5 A Paulson-Type Procedure Based on Likelihood Ratios, 122
  - 6.6 Selection of the Normal Population with the Smallest Variance, 124

94

6.7 6.8	S K C	electic Loopm Other (	on from Populations Belonging to an-Darmois Family, 125 Contributions, 127	
	6	.8.1	Identification Problems, 127	
SEL	ECT	ion fr	OM MULTIVARIATE POPULATIONS	130
7.1 7.2	1 1 2 1	Introdu Rankii Popula	uction, 130 ng of Several Multivariate Normal ations, 131	
		7.2.1 7.2.2	Selection in Terms of Mahalanobis Distance, 131 Selection in Terms of the Generalized Variance, 135	
		7.2.3	Selection in Terms of Multiple Correlation Coefficients, 136	
		7.2.4	Selection in Terms of the Sum of Bivariate Product-Moment Correlations, 137	
		7.2.5	Selection in Terms of the Coefficient of Alienation, 137	
7.	.3	Proce Popul	dures Relating to a Single Multivariate Normal ation, 138	
		7.3.1	Selection of the Component with the Largest Population Mean (Equal Known Variances), 139	
		7.3.2	Variance, 139	
		7.3.3	Selection of a Subclass of Components with the Smallest Population Generalized Variance, 140	
7	7.4	Note	s and Remarks, 140	
8 N	[oni	PARAM	ETRIC SELECTION PROCEDURES	14
	8.1 8.2 8.3	Intro Selec Selec Stati	eduction, 143 etion in Terms of Quantiles, 143 etion Procedures Based on Rank Order estics, 146	
		8.3.1 8.3.2 8.3.3	A Class of Procedures Based on Ranks, 146 More Procedures Based on Ranks, 148 Selection Procedures Based on Hodges-Lehmann Estimators, 152	

142

CONTENTS

## xii

- 8.3.4 An Optimal Procedure Based on Relative Rank—The Secretary Problem, 156
- 8.4 An Adaptive Procedure for the Largest Location Parameter, 158
- 8.5 Selection Procedures Using Paired Comparisons, 159
- 8.6 Inverse Sampling and Other Procedures for Tournaments with Two or Three Players, 164
  - 8.6.1 Inverse Sampling Procedure  $R_I$ , 165
  - 8.6.2 Inverse Sampling with Elimination: Procedure  $R_E$ , 167
  - 8.6.3 Other Sequential Procedures, 167
  - 8.6.4 The Modified Formulation of Bechhofer, 168
  - 8.6.5 A Single-Stage Procedure  $R_B$ , 169
  - 8.6.6 A Sequential Identification Procedure  $R_0$ , 170
  - 8.6.7 Some Remarks on Sobel–Weiss and Bechhofer Procedures, 173
- 8.7 Selection in Terms of Rank Correlation, 173
  - 8.7.1 Selection from Bivariate Populations, 173
  - 8.7.2 Selection from Multivariate Populations, 174
- 8.8 Notes and Remarks, 174
- 9 FIXED-SIZE SUBSET SELECTION: A GENERALIZED GOAL AND OTHER MODIFICATIONS

176

- 9.1 Introduction, 176
- 9.2 Fixed-Size Subset Selection with Generalized Goal, 177
  - 9.2.1 A Fixed-Sample Procedure, 177
  - 9.2.2 An Inverse Problem, 178
  - 9.2.3 Nonparametric Procedures, 179
  - 9.2.4 Selection from Restricted Family of Distributions, 181
- 9.3 An Adaptive Sequential Procedure, 183
- 9.4 Notes and Remarks, 185

### 10 BAYESIAN SELECTION AND RANKING PROCEDURES 187

- 10.1 Introduction, 187
- 10.2 Selecting the Largest of k Normal Population Means:

Determination of Sample Size to Achieve a Specified Probability of a Correct Selection, 188

- 10.3 Selection of the Largest Normal Mean Using a Linear Loss Function, 190
- 10.4 Selection of the Best of Several Processes: Analysis in Terms of Differential Utility, 192
- 10.5 Selection of the Best Population Using Utility Functions Involving Coverages, 195
  - 10.5.1 The Case of Normal Populations, 19510.5.2 The Case of Exponential Populations, 196
- 10.6 Bayesian Procedures for Complete Ranking, 197

- 10.7 Partial Ranking of Binomial Probabilities, 199
- 10.8 Notes and Remarks, 200

### PART II: SUBSET SELECTION FORMULATION

11 SUBSET SELECTION: GENERAL THEORY

- 11.1 Introduction, 204
- 11.2 Basic General Theory, 204
  - 11.2.1 Formulation of the Problem, 204
  - 11.2.2 The Class of Procedures  $R_h$ , 205
  - 11.2.3 Some Properties of  $R_h$ , 207
  - 11.2.4 Some Special Cases, 208
  - 11.2.5 A Decision-Theoretic Formulation and Best Invariant Rules, 211
  - 11.2.6 A Desirable Property of the Probability of a Correct Selection, 215
  - 11.2.7 A Generalization of the Subset Selection Goal, 218
- 11.3 A Restricted Subset Selection Formulation, 220
  - 11.3.1 Formulation, 220
  - 11.3.2 The Class of Procedures R(n), 222
  - 11.3.3 Probability of a Correct Selection and Its Infimum over  $\Omega(p)$ , 222

<sup>10.6.1</sup> Loss Functions Depending on  $\theta_i$ , 198 10.6.2 Comparison of Ranking Procedures, 198

- 11.3.4 Properties of  $\{R(n)\}$ , 223
- 11.3.5 A Generalized Goal for Restricted Subset Selection, 225
- 11.4 A Modified Goal: Elimination of Nonbest Populations, 225
  - 11.4.1 Formulation of the Problem, 225
  - 11.4.2 Location Parameter Case, 226
  - 11.4.3 Elimination of Non-t-best Populations, 228
  - 11.4.4 Selection of  $\Delta_p$ -Superior Populations, 228
- 11.5 Notes and Remarks, 229

## 12 Selection from Univariate Continuous Populations

- 12.1 Introduction, 231
- 12.2 Selection from Normal Populations in Terms of the Means, 232
  - 12.2.1 Equal Sample Sizes and Common Known Variance, 232
  - 12.2.2 Equal Sample Sizes and Common Unknown Variance, 233
  - 12.2.3 Unequal Sample Sizes and Common Known Variance, 233
  - 12.2.4 Unequal Sample Sizes and Common Unknown Variance, 235
  - 12.2.5 Allocation of Sample Sizes When Variances Are Unknown, 237
  - 12.2.6 A Procedure Based on Contrasts of Sample Means, 238
  - 12.2.7 Restricted Subset Size Procedures, 240
  - 12.2.8 A Two-Stage Procedure for Selecting Good Populations, 241
- 12.3 Selection from Normal Populations in Terms of the Absolute Values of the Means, 242
- 12.4 Selection from Normal Populations in Terms of the Variances, 243
  - 12.4.1 Equal Sample Sizes, 244
  - 12.4.2 Unequal Sample Sizes, 244
  - 12.4.3 Selecting the t Best Populations, 245
  - 12.4.4 Procedures Based on Sample Ranges, 245

# 12.5 Selection from Normal Populations in Terms of the Coverages of a Fixed Interval, 246

- 12.5.1 Unknown Means and Common Known Variance, 246
- 12.5.2 Unknown Means and Known Variances, 247
- 12.5.3 Unknown Means and Common Unknown Variance, 247
- 12.5.4 Common Known Mean and Unknown Variances, 247
- 12.5.5 Known Means and Unknown Variances, 248
- 12.5.6 Unknown Common Mean and Unknown Variances, 249
- 12.6 Selection from Gamma Populations in Terms of the Scale Parameters, 249
- 12.7 Selection from Exponential Populations in Terms of the Coverages of a Fixed Interval, 251
- 12.8 Selection from Uniform Populations, 252
- 12.9 Notes and Remarks, 253

# 13 SELECTION FROM DISCRETE POPULATIONS

- 13.1 Introduction, 255
- 13.2 Selection from Binomial Populations, 255
  - 13.2.1 Selection in Terms of Success Probabilities: Fixed Sample Size Rules, 255
  - 13.2.2 Selection in Terms of Success Probabilities: Conditional Rules, 258
  - 13.2.3 Selection in Terms of Success Probabilities: Inverse Sampling Rules, 261
  - 13.2.4 Selection in Terms of Entropy Functions, 262
  - 13.2.5 Elimination of Inferior Populations, 265
  - 13.3 Selection from Poisson Populations, 266
    - 13.3.1 Usual Location- and Scale-Type Procedures, 266
      - 13.3.2 A Modified Procedure, 266
      - 13.3.3 Conditional Procedures, 267
      - 13.3.4 Selecting the Population Associated with  $\lambda_{[1]}$ , 268
      - 13.3.5 A Procedure Using Inverse Sampling, 269
  - 13.4 Selection from Negative Binomial and Fisher's

Logarithmic Distributions, 271

13.5 Selection from Hypergeometric Distributions, 272

xvi

- 13.6 Selection from Multinomial Distributions. 273 Selection of the Best Multinomial Cell, 273 13.6.1 13.6.2 Selection from Finite Schemes, 276 13.7 Notes and Remarks, 278 280 SELECTION FROM MULTIVARIATE NORMAL POPULATIONS 14 Introduction, 280 14.1 Selection of the Best Component of a Multivariate 14.2 Normal Population, 281 14.2.1 Selection in Terms of the Means, 281 14.2.2 Selection in Terms of the Variances, 283 14.2.3 Selection of the Best Subclass of Components in Terms of the Generalized Variances, 284 Selection from Several Multivariate Normal 14.3 Populations, 285 Selection in Terms of Mahalanobis Distance 14.3.1 Function, 285 14.3.2 Selection in Terms of Generalized Variances, 288 14.3.3 Selection in Terms of Multiple Correlation Coefficients, 290 Selection in Terms of Measures of Association 14.3.4 between Two Subclasses of Variates, 292 14.3.5 Other Ranking Measures, 295 14.4 Notes and Remarks, 295 297 NONPARAMETRIC PROCEDURES 15 15.1 Introduction, 297 15.2 Selection in Terms of Quantiles, 298 15.3 Procedures Based on Ranks, 300 15.4 Procedures Based on Estimators, 308 Elimination of Strictly Non-t-Best 15.4.1 Populations, 308 15.4.2 Generalized Goal of Selecting a Subcollection of Subsets of Fixed Size, 310 Selection of Regression Equation with the Largest 15.5 Slope, 310 15.6 Procedures Based on Paired Comparisons, 313 Selection from Multivariate Populations in Terms of 15.7 Rank Correlation, 315
  - 15.8 Notes and Remarks, 316

16	Selec Distr	TION FROM RESTRICTED FAMILIES OF PROBABILITY	317
	16.1	Introduction, 317	
		<ul> <li>16.1.1 Partial Ordering in the Space of Probability Distributions, 318</li> <li>16.1.2 The Setup of the Problem, 319</li> </ul>	
	16.2	Selection in Terms of Quantiles from Distributions Starshaped w.r.t. $G$ , 319	
	16.3	Selection in Terms of the Medians for Distributions r-Ordered w.r.t. $G$ , 324	
	16.4	Selection Procedures Based on Generalized Total Life Statistics, 325	
	16.5	Selection in Terms of the Means for the Class of IFR Distributions, 327	
	16.6	A General Partial Order Relation and a Related Selection Problem, 328	
	16.7	Notes and Remarks, 329	
17	Sequ	JENTIAL PROCEDURES	331
	17.1 17.2	Introduction, 331 A Class of Noneliminating Procedures for Normal Populations, 332	
	17.3 17.4	Procedures with Restrictions on the Subset Size, 336 Selection of Mildly t Best Populations, 339	
		<ul><li>17.4.1 Parametric Procedures, 339</li><li>17.4.2 A Nonparametric Procedure, 343</li></ul>	
18	BAY	es, Empirical Bayes, and $\Gamma$ -Minimax Procedures	345
	18.1 18.2	Introduction, 345 Bayes Procedures, 345	
		<ul> <li>18.2.1 Procedures with Linear Loss Functions, 346</li> <li>18.2.2 Nonlinear Loss Functions, 347</li> <li>18.2.3 Selection Problem as a Restricted Product of Two-Decision Problems, 353</li> </ul>	
	18.3	<ul> <li>Empirical Bayes Procedures, 354</li> <li>C-Minimax Procedures, 355</li> </ul>	

18.4 Γ-Minimax Procedures, 3:18.5 Notes and Remarks, 357

xviii

### 19 Some Modified Formulations and Other Related Problems

- 19.1 Introduction, 358
- 19.2 Selecting a Subset Containing at Least One of the t Best Populations, 358
  - 19.2.1 Procedure R, 360
  - 19.2.2 Procedure R', 361
  - 19.2.3 Procedure  $R_M$ , 362
  - 19.2.4 Truncated Versions of R, R', and  $R_M$ , 362
  - 19.2.5 Comparisons of Procedures, 362
- 19.3 Subset Selection with Modified Requirements, 364
- 19.4 A Subset Selection Formulation of the Complete Ranking Problem, 367
  - 19.4.1 Location Parameter Case, 368
  - 19.4.2 Scale Parameter Case, 369

### PART III: COMPARISON WITH A CONTROL, ESTIMATION, AND RELATED TOPICS

20 COMPARISON OF SEVERAL POPULATIONS WITH A STANDARD OR A CONTROL

373

- 20.1 Introduction, 374
- 20.2 (k+1)-Decision Procedures for Comparing k Experimental Categories with a Standard or Control, 375
  - 20.2.1 Comparison of Normal Means, 375
  - 20.2.2 Comparison of Normal Means: Modified Probability Requirements, 377
  - 20.2.3 Comparison of Processes with Regard to Conforming to Product Specifications, 380
  - 20.2.4 Some General Results for Comparison of Several Populations with a Specified Standard, 382
- 20.3 Asymptotically Optimal Procedures, 383
  - 20.3.1 Fixed Sample Size Procedures, 383
  - 20.3.2 Sequential Procedures, 384

- 20.4 Choosing All Populations That Are Better than a Control, 385
- 20.5 Selecting a Subset Containing All Populations Better than a Control, 386
  - 20.5.1 Parametric Procedures, 387
  - 20.5.2 Nonparametric Procedures, 389
  - 20.5.3 Procedures with Modified Requirements, 395
- 20.6 Partitioning a Set of Populations with Respect to a Control, 395
  - 20.6.1 Normal Populations, 396
  - 20.6.2 Exponential Populations, 402
- 20.7 Lehmann's Formulation, 404
  - 20.7.1 A Minimax Solution, 405
  - 20.7.2 Normal Populations with Common Unknown Variance, 406
- 20.8 Comparison of Multivariate Normal Populations, 406
  - 20.8.1 Comparisons in Terms of Linear Combinations of the Mean Vectors, 406
  - 20.8.2 Comparisons Based on Distance Functions, 408
  - 20.8.3 Partitioning a Set of Multivariate Normal Populations, 409
- 20.9 **F-Minimax and Bayes Procedures**, 411
  - 20.9.1 Γ-Minimax Procedures for Translation Parameter Family, 411
  - 20.9.2 Bayes Procedures for Comparison with a Standard, 413
  - 20.9.3 Bayes Procedure for Partitioning a Set of Normal Populations, 415
- 20.10 Multiple Comparisons with a Control: One-Sided and Two-Sided Intervals, and Optimal Allocation of Observations, 415
  - 20.10.1 One- and Two-Sided Comparisons: Equal Variances Case, 416
  - 20.10.2 One- and Two-Sided Comparisons: Unequal Known Variances, 417
  - 20.10.3 Multiple Comparisons with a Control for Multiply Classified Variances of Normal Populations, 420

ΧХ

### 21 ESTIMATION OF ORDERED PARAMETERS

- 21.1 Introduction, 423
- 21.2 Point Estimation, 423
  - 21.2.1 Estimation of the Larger Translation Parameter, 423
  - 21.2.2 A Natural Estimator of  $\theta_{[i]}$ , 426
  - 21.2.3 Maximum Likelihood Estimators for Ranked Means, 426
  - 21.2.4 Maximum Probability Estimators for Ranked Means, 427
  - 21.2.5 A Two-Sample Estimator of the Largest Normal Mean, 428
  - 21.2.6 Estimation of Ordered Parameters with Prior Information: Isotonic Regression, 429
- 21.3 Confidence Intervals for Ordered Parameters: Some General Results, 431
  - 21.3.1 Confidence Interval for  $\theta_{ij}$ , 432
  - 21.3.2 An Alternative Two-Sided Interval, 433
- 21.4 Confidence Intervals for Ordered Parameters: Location and Scale Parameters, 434
  - 21.4.1 Location Parameters, 434
  - 21.4.2 Scale Parameters, 437
- 21.5 Interval Estimation of Ordered Means from k Normal Populations, 440
  - 21.5.1 Interval Estimation of the Ordered Means of Two Normal Populations Based on Hybrid Estimators: Known Variances, 440
  - 21.5.2 Single-Stage Procedures with Unknown Equal Variances, 442
  - 21.5.3 Two-Stage Procedure with Unknown Variances, 444
  - 21.5.4 Efficiency of Some Multistage Procedures, 446
  - 21.5.5 A Sequential Procedure, 447
  - 21.5.6 Interval Estimation of the Largest Mean: Unequal Sample Sizes, 448
- 21.6 Interval Estimation of the Largest  $\alpha$ -Quantile, 450
- 21.7 Combined Goals of Selection and Estimation, 452
  - 21.7.1 A Selection and Estimation Problem for Poisson Processes, 452

- 21.7.2 Interval Estimation and Simultaneous Selection: Location and Scale Parameters, 453
- 21.8 Tolerance Intervals for Stochastically Ordered Distributions, 455
- 21.9 Notes and Remarks, 458
- 22 GENERAL THEORY OF SOME MULTIPLE-DECISION PROBLEMS AND SOME MISCELLANEOUS TOPICS

459

- 22.1 Introduction, 459
- 22.2 General Theory of Some Multiple Decision Problems, 460
  - 22.2.1 A Class of Multiple Decision Problems, 460
  - 22.2.2 Restricted Products of Decision Problems, 463
  - 22.2.3 Decision Procedures Allowing Partial Conclusions, 464
  - 22.2.4 Some Further Results on Multiple Decision Problems, 465
- 22.3 Selection of Variables in Linear Regression, 466
  - 22.3.1 Computational Techniques, 467
  - 22.3.2 Selection Criteria, 468
  - 22.3.3 Subset Selection Problems for Variances with Applications to Regression Analysis, 469
  - 22.3.4 An Indifference-Zone Approach for Selecting the Best Predictor Variate, 472
- 22.4 Slippage Tests, 472
  - 22.4.1 A Decision-Theoretic Formulation, 472
  - 22.4.2 Some Additional Results, 474
- 23 GUIDE TO TABLES
  - 23.1 Introduction, 475
  - 23.2 Tables Relating to Multivariate Normal Integrals, 476
  - 23.3 Tables Relating to Multivariate t, 483
  - 23.4 Tables for the Studentized Largest and Smallest Chi-Square Distributions, 487
  - 23.5 Additional Tables for Chi-Square Distributions, 489
  - 23.6 Distributions of Maximum and Minimum of F Ratios, 491

xxii

	23.7 23.8	Distributions of Maximum and Minimum of Ratios and Differences of Order Statistics, 492 Tables Relating to Discrete Distributions, 494	
		<ul> <li>23.8.1 Binomial Distribution, 494</li> <li>23.8.2 Hypergeometric Distribution, 496</li> <li>23.8.3 Multinomial Distribution, 497</li> </ul>	
	23.9	Some Miscellanceous Tables, 498	
24	ILLUS	TRATIVE EXAMPLES	501
	24.1 24.2 24.3 24.4 24.5 24.6 24.7 24.8 24.9 24.10 24.11	Introduction, 501 Normal Means, 501 Normal Variances, 507 Binomial Proportions, 508 Poisson Processes, 510 Gamma Populations, 511 Multinomial Cells, 512 Nonparametric Procedures, 512 Restricted Families of Distributions, 514 Multivariate Normal Populations, 516 Selection of the Largest Location Parameter: Procedures Based on Sample Medians, 517	
Вів	LIOGRA	лрну	520
Rel	ATED R	LEFERENCES	553
Mo or F	NOGRAI PARTIAI	phs. Books and Special Issues of Journals Devoted Fully lly to Ranking and Selection Problems	561
Aut	fhor In	DEX	563

Subject Index