

Contents

CHAPTER I HISTORICAL SURVEY OF χ^2	1
1. Forerunners of the Pearson χ^2	1
2. The Contributions of K. Pearson	3
3. The Contributions of R. A. Fisher	6
4. Some Quotations of Historical Interest	7
CHAPTER II DISTRIBUTION THEORY	17
1. The Gamma Variable	17
2. The χ^2 Variable	18
3. Some Properties of the χ^2 Distribution	20
4. Tables of the χ^2 Distribution	21
5. The Distribution of Quadratic Forms in Normal Variables	22
Exercises and Complements	25
CHAPTER III DISCRETE DISTRIBUTIONS	30
1. Condensation and Randomized Partitions	30
2. Significance Tests in Discrete Distributions	32
3. The Normal Approximation to the Binomial Distribution	34
4. The Normal Approximation to the Hypergeo- metric and Poisson Distributions	35
5. The Normal or χ^2 Approximation to the Multi- nomial Distribution	36
Exercises and Complements	39
CHAPTER IV ORTHOGONALITY	41
1. Orthogonal Matrices	41
2. The Formation of Orthogonal Matrices from other Orthogonal Matrices	42

3. Sets of Orthogonal Functions on a Finite Set of Points	45
4. Orthonormal Polynomials and Functions on Statistical Distributions	47
Exercises and Complements	52
CHAPTER V THE MULTINOMIAL DISTRIBUTION	64
1. Introductory	64
2. The Multivariate Central Limit Theorem	67
3. The Proofs of K. Pearson	70
4. Stirling's Approximation	72
5. The Proof of H. E. Soper	74
6. The Factorization Proof	75
7. The Proof by Curve Fitting (Lexis Theory)	76
8. Analogues of the Pearson χ^2	76
9. Empirical Verifications of the Distribution of the Discrete χ^2	77
10. Applications of χ^2 in the Multinomial Distribution	78
Exercises and Complements	80
CHAPTER VI CANONICAL OR STANDARD FORMS FOR PROBABILITY DISTRIBUTIONS	84
1. Probability Measures	84
2. Finite Discrete Distributions in Two Dimensions	89
3. ϕ^2 -bounded Bivariate Distributions	91
4. The General Bivariate Distribution	96
5. Multivariate Distributions	100
6. Independence and Association	106
Exercises and Complements	107
CHAPTER VII NON-CENTRAL χ^2	117
1. Distribution Theory	117
2. The Comparison of Two Normal Populations	119
3. Analogues of the Pearson χ^2 , the Combination of Probabilities	121
Exercises and Complements	125

CHAPTER VIII TESTS OF GOODNESS OF FIT IN THE MULTINOMIAL DISTRIBUTION	135
1. Introductory	135
2. Least Squares and Minimum χ^2	136
3. The Fitting of Sufficient Statistics	139
4. χ^2 in the Multinomial Distribution with Estimated Parameters (Fisher Theory)	142
5. Estimated Parameters (Cramér Theory)	144
6. Estimated Parameters and Orthonormal Theory	148
7. The Test of Goodness of Fit	150
Exercises and Complements	154
CHAPTER IX PROBLEMS OF INFERENCE	161
1. Introductory	161
2. Tests of Hypotheses	162
3. Significance Levels	164
4. The Likelihood Ratio Test and χ^2	165
5. Multiple Comparisons	167
6. Grouping, or Choice of Partitions of the Measure Space	168
7. Large Values of χ^2	169
8. Small Values of χ^2	172
9. Hidden Parameters	173
10. χ^2 and the Sample Size	174
11. Small Class Frequencies	175
12. The Partition of χ^2	175
13. Misclassification and Missing Values	177
14. The Reconciliation of χ^2	178
15. Miscellaneous Inference	178
Exercises and Complements	178
CHAPTER X NORMAL CORRELATION	188
1. Introductory	188
2. The Partial Correlations	189
3. The Canonical Correlations of Hotelling	190
4. Kolmogorov's Canonical Problem	191
5. Multivariate Normality	193
6. The Canonical Correlations	194
7. The Wishart Distribution	197
8. Tetrachoric Correlation	197

9. The Polychoric Series	199
10. The Correlation Ratio	201
11. Biserial η	202
12. Tests of Normality	203
13. Various Measures of Correlation	203
Exercises and Complements	203
 CHAPTER XI TWO-WAY CONTINGENCY TABLES	 211
1. Introductory	211
2. Probability Models in a Two-way Contingency Table	212
3. Tests of Independence	217
4. The Fourfold Table	219
5. Combinatorial Theory of the Two-way Tables	226
6. Asymptotic Theory of the Two-way Tables	228
7. Parameters of Non-Centrality	231
8. Symmetry and Exchangeability in Two-way Tables	234
9. Reparametrization	237
10. Measures of Association	238
11. The Homogeneity of Several Populations	240
12. Contingency Tables—Miscellaneous Topics	240
Exercises and Complements	240
 CHAPTER XII CONTINGENCY TABLES OF HIGHER DIMENSIONS	 252
1. Introductory and Historical	252
2. Interactions and Generalized Correlations	254
3. Models	260
4. Combinatorial Theory	265
5. The Fisher-Bartlett Methods	265
6. Asymptotic Theory	267
7. Canonical Variables	270
8. Exchangeable Random Variables and Symmetry	271
Exercises and Complements	273
 BIBLIOGRAPHY	 283
INDEX TO THE BIBLIOGRAPHY	337
SUBJECT INDEX	351

