Contents

CHAPTER		
One	Introduction	1
	1.1 Scope of This Book and Prerequisites for Its Study	1
	1.2 Expository Approach and Organization of This Book	3
Two	Mathematical Preliminaries: Some Matrix Algebra	7
	2.1 Definitions and Basic Terminology	7
	2.2 Addition of Matrices; Multiplication of a Matrix by a Scalar	10
	2.3 Multiplication of Two Matrices	13
	2.4 The Identity Matrix and Matrix Inversion	21
	2.5 Multiple Regression: Review and Matrix Formulation	26
Three	Analysis of Covariance with More than One Covariate	39
	3.1 Analysis of Covariance with One Covariate	40
	3.2 An Example	48
	3.3 Covariance Analysis with Several Covariates	51
	3.4 Numerical Example	56
Four	Multivariate Significance Tests of Group Differences	62
	4.1 The Multivariate Normal Distribution	63
	4.2 The Sampling Distribution of Sample Centroids	73
	4.3 Significance Test: One-Sample Problem	76
	4.4 Significance Test: Two-Sample Problem	81
	4.5 Significance Test: K-Sample Problem	84
Five	More Matrix Algebra: Linear Transformation, Axis Rotation, and Eigenvalue Problems	94
	5.1 Linear Transformations and Axis Rotation	94

	5.2 The Effect of a Linear Transformation on an SSCP Matrix	105
	5.3 Variance-Maximizing Rotations	111
	5.4 Solution of Equation for Variance-Maximizing Rotations: Eigenvalue Problems	117
	5.5 Some Properties of Matrices Related to Eigenvalues and Eigenvectors	125
	5.6 Applications of Principal Components Analysis	144
	5.7 Theoretical Supplement: Generalized Inverses	149
Six	Discriminant Analysis and Canonical Correlation	157
	6.1 The Discriminant Criterion	157
	6.2 Maximizing the Discriminant Criterion	160
	6.3 Discriminant Functions	161
	6.4 Significance Tests in Discriminant Analysis	164
	6.5 Numerical Example	166
	6.6 Special Case of Two Groups	170
	6.7 A Canonical Correlations Approach to Discriminant Analysis	177
	6.8 Canonical Correlation Analysis	183
	6.9 Significance Tests of Canonical Variates	186
	6.10 Interpretation of the Canonical Variates	190
Seven	Multivariate Analysis of Variance	194
	7.1 Two-Factor Designs with Multiple Dependent Variables: Additive Components of the Total SSCP Matrix	194
	7.2 Significance Tests in MANOVA	197
	7.3 Numerical Example	200
	7.4 Discriminant Analysis in Factorial Designs	206
	7.5 Other Designs	210
	7.6 Other Test Criteria	212
	7.7 Suggested Further Readings	214
Eight	Applications to Classification Problems	217
	8.1 Classification and the Concept of Resemblance	218
	8.2 Taking Prior Probabilities into Consideration	225
	8.3 Probability of Group Membership	228
	8.4 Reduction of Dimensionality by Discriminant Analysis	232
	8.5 Joint Probability of Group Membership and Success	237
APPENDIX		
A	Determinants	243
B	Pivotal Condensation Method of Matrix Inversion	253

C	Symbolic Differentiation by Vectors or Matrices	261
D	Principal Components (or Factors) by Hotelling's Iterative Procedure for Solving Eigenvalue Problems	269
E	Statistical and Numerical Tables	276
F	Answers to Exercises	291
REFERENCES		301
INDEX		305