

Contents

<i>Preface</i>		xi
<i>Acknowledgments</i>		xiii
<i>Chapter 1</i>	The Nature of Multivariate Data Analysis	
1.1	Introduction	1
1.2	Multivariate Methods in Research	2
1.3	A Classification of Techniques for Analyzing Associative Data	4
1.4	Organizing the Techniques	8
1.5	Illustrative Applications	11
1.6	Some Numerical Examples	14
1.7	Format of Succeeding Chapters	23
1.8	Summary	24
	Review Questions	25
<i>Chapter 2</i>	Vector and Matrix Operations for Multivariate Analysis	
2.1	Introduction	26
2.2	Vector Representation	27
2.3	Basic Definitions and Operations on Vectors	27
2.4	Matrix Representation	40
2.5	Basic Definitions and Operations on Matrices	40
2.6	Some Special Matrices	52
2.7	Determinants of Matrices	58
2.8	Applying Matrix Operations to Statistical Data	69
2.9	Summary	73
	Review Questions	74

Chapter 3 Vector and Matrix Concepts from a Geometric Viewpoint

3.1	Introduction	77
3.2	Euclidean Space and Rectangular Cartesian Coordinates	78
3.3	Geometric Representation of Vectors	85
3.4	Linear Dependence of Vectors	101
3.5	Orthogonal Transformations	111
3.6	Geometric Aspects of Cross-Product Matrices and Determinants	118
3.7	Summary	124
	Review Questions	125

Chapter 4 Linear Transformations from a Geometric Viewpoint

4.1	Introduction	127
4.2	Simultaneous Equations and Matrix Transformations	128
4.3	Matrix Inversion	136
4.4	Geometric Relationships Involving Matrix Transformations	147
4.5	Composite Transformations	156
4.6	Invertible Transformations and Matrix Rank	163
4.7	Methods for Rank Determination and Matrix Inversion	176
4.8	Summary	189
	Review Questions	190

Chapter 5 Decomposition of Matrix Transformations: Eigenstructures and Quadratic Forms

5.1	Introduction	194
5.2	An Overview of Matrix Eigenstructures	195
5.3	Transformations of Covariance Matrices	207
5.4	Eigenstructure of a Symmetric Matrix	210
5.5	Properties of Matrix Eigenstructures	219
5.6	Eigenstructures and Matrix Rank	225
5.7	The Basic Structure of a Matrix	230
5.8	Quadratic Forms	240
5.9	Eigenstructures of Nonsymmetric Matrices in Multivariate Analysis	247
5.10	Summary	255
	Review Questions	256

Chapter 6 Applying the Tools to Multivariate Data

6.1	Introduction	259
6.2	The Multiple Regression Problem	260
6.3	Other Forms of the General Linear Model	270

6.4	The Factor Analysis Problem	272
6.5	The Multiple Discriminant Analysis Problem	278
6.6	A Parting Look at Multivariate Technique Classification	286
6.7	Summary	293
	Review Questions	294
<i>Appendix A</i>	Symbolic Differentiation and Optimization of Multivariable Functions	
A.1	Introduction	295
A.2	Differentiation of Functions of One Argument	296
A.3	Differentiation of Functions of Two Arguments	304
A.4	Symbolic Differentiation	312
A.5	Application of the Calculus to Multivariate Analysis	318
A.6	Summary	320
	Review Questions	321
<i>Appendix B</i>	Linear Equations and Generalized Inverses	
B.1	Introduction	323
B.2	Simultaneous Linear Equations	324
B.3	Introductory Aspects of Generalized Inverses	334
B.4	The g Inverse	343
B.5	Summary	350
	Review Questions	350
	Answers to Numerical Problems	352
	References	364
	<i>Index</i>	369