
Contents

Preface	ix
1 Setting the Scene	1
1.1 Structure of the book	1
1.2 Our limited use of mathematics	4
1.3 Variables	7
1.4 The geometry of multivariate analysis	9
1.5 Use of examples	10
1.6 Data inspection, transformations, and missing data	12
1.7 A final word	13
1.8 Reading	13
2 Cluster Analysis	15
2.1 Classification in social sciences	15
2.2 Some methods of cluster analysis	18
2.3 Graphical presentation of results	23
2.4 Derivation of the distance matrix	27
2.5 Example on English dialects	31
2.6 Comparisons	37
2.7 Clustering variables	39
2.8 Further examples and suggestions for further work	39
2.9 Further reading	51
3 Multidimensional Scaling	53
3.1 Introduction	53
3.2 Examples	55
3.3 Classical, ordinal, and metrical multidimensional scaling	59
3.4 Comments on computational procedures	62
3.5 Assessing fit and choosing the number of dimensions	63
3.6 A worked example: dimensions of colour vision	64
3.7 Further examples and suggestions for further work	68
3.8 Further reading	79
4 Correspondence Analysis	81
4.1 Aims of correspondence analysis	81

4.2	Carrying out a correspondence analysis: a simple numerical example	83
4.3	Carrying out a correspondence analysis: the general method	88
4.4	The biplot	91
4.5	Interpretation of dimensions	95
4.6	Choosing the number of dimensions	97
4.7	Example: confidence in purchasing from European Community countries	99
4.8	Correspondence analysis of multi-way tables	105
4.9	Further examples and suggestions for further work	109
4.10	Further reading	114
5	Principal Components Analysis	115
5.1	Introduction	115
5.2	Some potential applications	116
5.3	Illustration of PCA for two variables	117
5.4	An outline of PCA	120
5.5	Examples	122
5.6	Component scores	129
5.7	The link between PCA and multidimensional scaling, and between PCA and correspondence analysis	132
5.8	Using principal component scores to replace original variables	134
5.9	Further examples and suggestions for further work	136
5.10	Further reading	141
6	Factor Analysis	143
6.1	Introduction to latent variable models	143
6.2	The linear single-factor model	146
6.3	The general linear factor model	149
6.4	Interpretation	152
6.5	Adequacy of the model and choice of the number of factors	154
6.6	Rotation	156
6.7	Factor scores	160
6.8	A worked example: the test anxiety inventory	161
6.9	How rotation helps interpretation	166
6.10	A comparison of factor analysis and principal component analysis	167
6.11	Further examples and suggestions for further work	169
6.12	Further reading	174
7	Factor Analysis for Binary Data	175
7.1	Latent trait models	175
7.2	Why is the factor analysis model for metrical variables invalid for binary responses?	178
7.3	Factor model for binary data	179
7.4	Goodness-of-fit	184

7.5	Factor scores	188
7.6	Rotation	190
7.7	Underlying variable approach	190
7.8	Example: sexual attitudes	192
7.9	Further examples and suggestions for further work	197
7.10	Software	206
7.11	Further reading	206
8	Factor Analysis for Ordered Categorical Variables	207
8.1	The practical background	207
8.2	Two approaches to modelling ordered categorical data	208
8.3	Item response function approach	209
8.4	Examples	216
8.5	The underlying variable approach	219
8.6	Unordered and partially ordered observed variables	224
8.7	Further examples and suggestions for further work	228
8.8	Software	234
8.9	Further reading	234
9	Latent Class Analysis for Binary Data	235
9.1	Introduction	235
9.2	The latent class model for binary data	236
9.3	Example: attitude to science and technology data	241
9.4	How can we distinguish the latent class model from the latent trait model?	245
9.5	Latent class analysis, cluster analysis, and latent profile analysis	247
9.6	Further examples and suggestions for further work	248
9.7	Software	252
9.8	Further reading	252
	References	253
	Index	257