

Contents

Preface	vii
1 Introduction	1
1.1 Conditional Independence	1
1.2 Graphs	4
1.3 Data, Models, and Graphs	6
1.4 Simpson's Paradox	8
1.5 Overview of the Book	11
2 Discrete Models	13
2.1 Three-Way Tables	13
2.2 Example: Lizard Perching Behaviour	18
2.3 Multi-Way Tables	20
2.4 Example: Risk Factors for Coronary Heart Disease	24
2.5 Example: Chromosome Mapping	27
2.6 Example: University Admissions	32

3	Continuous Models	35
3.1	Graphical Gaussian Models	35
3.2	Example: Digoxin Clearance	42
3.3	Example: Anxiety and Anger	45
3.4	Example: Mathematics Marks	47
3.5	Regression Models	51
3.6	Example: Determinants of Bone Mineral Content	54
4	Mixed Models	61
4.1	CG-Distribution	61
4.2	Models with One Discrete and One Continuous Variable	62
4.3	A Model with Two Discrete and Two Continuous Variables	64
4.4	Model Formulae	65
4.5	Formulae and Graphs	66
4.6	Maximum Likelihood Estimation	68
4.7	Deviance	70
4.8	A Simple Example	72
4.9	The MANOVA Framework	75
4.10	Example: A Drug Trial Using Mice	77
4.11	Example: A Drug Trial Using Rats	80
4.12	Example: Lipids	83
4.13	Breaking Models into Smaller Ones	90
4.14	Decomposable Models	97
5	Hypothesis Testing	103
5.1	An Overview	103
5.2	χ^2 -Tests	104
5.3	F-Tests	106
5.4	Exact Conditional Tests	108
5.5	Deviance-Based Tests	112
5.6	Permutation F-Test	117

5.7	Pearson χ^2 Test	117
5.8	Fisher's Exact Test	118
5.9	Rank Tests	119
5.10	Wilcoxon Test	123
5.11	Kruskal-Wallis Test	127
5.12	Jonckheere-Terpstra Test	129
5.13	Tests for Variance Homogeneity	132
5.14	Tests for Equality of Means Given Homogeneity	133
5.15	Hotellings T^2	135
6	Model Selection and Criticism	137
6.1	Stepwise Selection	138
6.2	The EH-Procedure	146
6.3	Comparison of the Methods	149
6.4	Box-Cox Transformations	151
6.5	Residual Analysis	153
6.6	Dichotomization	162
7	Further Topics	169
7.1	Incomplete Data	170
7.2	Example: Estimating the Components of a Normal Mixture	177
7.3	Example: The Mathematics Marks Revisited	180
7.4	Discriminant Analysis	185
7.5	Example: Breast Cancer	187
7.6	Graphs with Directed Edges	192
7.7	Example: Side-Effects of Neuroleptika	196
7.8	Causal Inference	203

A	General MIM Commands	209
A.1	Introduction	209
A.2	Declaring Variables	210
A.3	Specifying Models	211
A.4	Reading and Manipulating Data	214
A.5	Parameter Estimation	220
A.6	Incomplete Data	222
A.7	Tests	226
A.8	Stepwise Selection	230
A.9	The EH-Procedure	232
A.10	The Box-Cox Transformation	233
A.11	Residuals	234
A.12	Discriminant Analysis	236
A.13	Utilities	236
B	Version-Specific Aspects	245
B.1	Versions	245
B.2	Calling MIM	246
B.3	Interactive Data Entry	248
B.4	Independence Graphs	249
B.5	Scatterplots	253
B.6	Histograms	254
B.7	Access to DOS	255
C	On the Dichotomized Normal Distribution	257
	References	267
	Index	277