

Contents

1	Introduction	<i>page</i> 1
1.1	Motivation	1
1.2	Choice Probabilities and Integration	3
1.3	Outline of Book	7
1.4	A Couple of Notes	8
Part I Behavioral Models		
2	Properties of Discrete Choice Models	11
2.1	Overview	11
2.2	The Choice Set	11
2.3	Derivation of Choice Probabilities	14
2.4	Specific Models	17
2.5	Identification of Choice Models	19
2.6	Aggregation	29
2.7	Forecasting	32
2.8	Recalibration of Constants	33
3	Logit	34
3.1	Choice Probabilities	34
3.2	The Scale Parameter	40
3.3	Power and Limitations of Logit	42
3.4	Nonlinear Representative Utility	52
3.5	Consumer Surplus	55
3.6	Derivatives and Elasticities	57
3.7	Estimation	60
3.8	Goodness of Fit and Hypothesis Testing	67
3.9	Case Study: Forecasting for a New Transit System	71
3.10	Derivation of Logit Probabilities	74
4	GEV	76
4.1	Introduction	76
4.2	Nested Logit	77

4.3	Three-Level Nested Logit	86
4.4	Overlapping Nests	89
4.5	Heteroskedastic Logit	92
4.6	The GEV Family	93
5	Probit	97
5.1	Choice Probabilities	97
5.2	Identification	100
5.3	Taste Variation	106
5.4	Substitution Patterns and Failure of IIA	108
5.5	Panel Data	110
5.6	Simulation of the Choice Probabilities	114
6	Mixed Logit	134
6.1	Choice Probabilities	134
6.2	Random Coefficients	137
6.3	Error Components	139
6.4	Substitution Patterns	141
6.5	Approximation to Any Random Utility Model	141
6.6	Simulation	144
6.7	Panel Data	145
6.8	Case Study	147
7	Variations on a Theme	151
7.1	Introduction	151
7.2	Stated-Preference and Revealed-Preference Data	152
7.3	Ranked Data	156
7.4	Ordered Responses	159
7.5	Contingent Valuation	164
7.6	Mixed Models	166
7.7	Dynamic Optimization	169
Part II Estimation		
8	Numerical Maximization	185
8.1	Motivation	185
8.2	Notation	185
8.3	Algorithms	187
8.4	Convergence Criterion	198
8.5	Local versus Global Maximum	199
8.6	Variance of the Estimates	200
8.7	Information Identity	202

9	Drawing from Densities	205
9.1	Introduction	205
9.2	Random Draws	205
9.3	Variance Reduction	214
10	Simulation-Assisted Estimation	237
10.1	Motivation	237
10.2	Definition of Estimators	238
10.3	The Central Limit Theorem	245
10.4	Properties of Traditional Estimators	247
10.5	Properties of Simulation-Based Estimators	250
10.6	Numerical Solution	257
11	Individual-Level Parameters	259
11.1	Introduction	259
11.2	Derivation of Conditional Distribution	262
11.3	Implications of Estimation of θ	264
11.4	Monte Carlo Illustration	267
11.5	Average Conditional Distribution	269
11.6	Case Study: Choice of Energy Supplier	270
11.7	Discussion	280
12	Bayesian Procedures	282
12.1	Introduction	282
12.2	Overview of Bayesian Concepts	284
12.3	Simulation of the Posterior Mean	291
12.4	Drawing from the Posterior	293
12.5	Posteriors for the Mean and Variance of a Normal Distribution	294
12.6	Hierarchical Bayes for Mixed Logit	299
12.7	Case Study: Choice of Energy Supplier	305
12.8	Bayesian Procedures for Probit Models	313
13	Endogeneity	315
13.1	Overview	315
13.2	The BLP Approach	318
13.3	Supply Side	328
13.4	Control Functions	334
13.5	Maximum Likelihood Approach	340
13.6	Case Study: Consumers' Choice among New Vehicles	342

14	EM Algorithms	347
14.1	Introduction	347
14.2	General Procedure	348
14.3	Examples of EM Algorithms	355
14.4	Case Study: Demand for Hydrogen Cars	365
	<i>Bibliography</i>	371
	<i>Index</i>	385