

Contents

Preface	v
Introduction	vii
Chapter 1 Sufficiency and completeness	1
1.1 Introduction	1
1.2 Sufficiency and factorization of densities	4
1.3 Sufficiency and exhaustivity	8
1.4 Minimal sufficiency	12
1.5 Completeness	17
1.6 Exponential families	22
1.7 Auxiliary results on families with monotone likelihood ratios	31
1.8 Ancillary statistics	44
1.9 Equivariance and invariance	49
1.10 Appendix: Conditional expectations, conditional distributions	55
Chapter 2 The evaluation of estimators	65
2.1 Introduction	65
2.2 Unbiasedness of estimators	68
2.3 The concentration of real valued estimators	74
2.4 Concentration of multivariate estimators	82
2.5 Evaluating estimators by loss functions	90
2.6 The relative efficiency of estimators	93
2.7 Examples on the evaluation of estimators	95
Chapter 3 Mean unbiased estimators and convex loss functions	101
3.1 Introduction	101
3.2 The Rao–Blackwell–Lehmann–Scheffé–Theorem	104
3.3 Examples of mean unbiased estimators with minimal convex risk	109
3.4 Mean unbiased estimation of probabilities	112
3.5 A result on bounded mean unbiased estimators	120

Chapter 4	Testing hypotheses	123
4.1	Basic concepts	123
4.2	Critical functions, critical regions	128
4.3	The Neyman–Pearson Lemma	133
4.4	Optimal tests for composite hypotheses	135
4.5	Optimal tests for families with monotone likelihood ratios	139
4.6	Tests of Neyman structure	143
4.7	Most powerful similar tests for a real parameter in the presence of a nuisance parameter	146
Chapter 5	Confidence procedures	157
5.1	Basic concepts	157
5.2	The evaluation of confidence procedures	160
5.3	The construction of one-sided confidence bounds and median unbiased estimators	167
5.4	Optimal one-sided confidence bounds and median unbiased estimators	171
5.5	Optimal one-sided confidence bounds and median unbiased estimators in the presence of a nuisance parameter	174
5.6	Examples of maximally concentrated confidence bounds	180
Chapter 6	Consistent estimators	187
6.1	Introduction	187
6.2	A general consistency theorem	189
6.3	Consistency of M -estimators	193
6.4	Consistent solutions of estimating equations	200
6.5	Consistency of maximum likelihood estimators	203
6.6	Examples of ML estimators	209
6.7	Appendix: Uniform integrability, stochastic convergence and measurable selection	213
Chapter 7	Asymptotic distributions of estimator sequences	225
7.1	Limit distributions	225
7.2	How to deal with limit distributions	231
7.3	Asymptotic confidence bounds	236
7.4	Solutions to estimating equations	240
7.5	The limit distribution of ML estimator sequences	247
7.6	Stochastic approximations to estimator sequences	251
7.7	Appendix: Weak convergence	255

Chapter 8 Asymptotic bounds for the concentration of estimators and confidence bounds	263
8.1 Introduction	263
8.2 Regular sequences of confidence bounds and median unbiased estimators	269
8.3 Sequences of confidence bounds and median unbiased estimators with limit distributions	276
8.4 The convolution theorem	278
8.5 Maximally concentrated limit distributions	288
8.6 Superefficiency	296
Chapter 9 Miscellaneous results on asymptotic distributions	305
9.1 Examples of ML estimators	305
9.2 Tolerance bounds	316
9.3 Probability measures with location- and scale parameters	320
9.4 Miscellaneous results on estimators	332
Chapter 10 Asymptotic test theory	337
10.1 Introduction	337
10.2 Tests for a real valued functional	338
10.3 The asymptotic envelope power function for tests for a real valued functional	341
References	345
Author Index	361
Subject Index	365
Notation Index	371