

Adopting a broad view, *Statistical Inference* concentrates on what various techniques do, with mathematical proofs kept to a minimum. The approach is rigorous but accessible to final year undergraduates. Classical approaches to point estimation, hypothesis testing and interval estimation are all covered thoroughly with recent developments outlined. Separate chapters are devoted to Bayesian inference, decision theory and non-parametric and robust inference. The increasingly important topics of computationally intensive methods and generalized linear models are also included.

In this new edition, the material on recent developments has been updated, new sections on local likelihood, estimating equations, and fiducial intervals have been added; and material on Gibbs sampling, tests based on ranks, bootstrap techniques, and generalized linear models has been revised substantially and expanded. Additional exercises are included in most chapters.

Statistical Inference is designed for use on final year undergraduate or postgraduate courses. It will also be useful to the working statistician as a reference for the basic ideas in statistical inference.

ALSO PUBLISHED BY OXFORD UNIVERSITY PRESS

Probability and Random Processes (Third edition)

G. R. Grimmett and D. R. Stirzaker

One Thousand Exercises in Probability

G. R. Grimmett and D. R. Stirzaker

Parametric Statistical Inference

J. K. Lindsey

Principles of Multivariate Analysis (Revised edition)

W. J. Krzanowski

Likelihood Methods in Statistics

T. A. Severini

OXFORD
UNIVERSITY PRESS

ISBN 978-0-19-857226-8



Contents

1	Introduction	1
1.1	Background	1
1.2	Plan of the book.....	3
1.3	Notation and terminology	4
2	Properties of estimators	7
2.1	Introduction	7
2.2	Unbiasedness	7
2.3	Consistency	8
2.4	Efficiency	10
2.5	Sufficiency	18
2.6	Exponential families of distributions	27
2.7	Complete sufficient statistics	31
2.8	Problems with MVUEs.....	33
2.9	Summary	34
2.10	Exercises	34
3	Maximum likelihood and other methods of estimation	40
3.1	Introduction	40
3.2	Maximum likelihood estimation	40
3.3	Modifications and extensions of maximum likelihood estimation	54
3.4	Other methods of estimation.....	60
3.5	Discussion	63
3.6	Exercises	64
4	Hypothesis testing	71
4.1	Introduction and some basic definitions	71
4.2	Simple null and alternative hypotheses—the Neyman–Pearson approach	71
4.3	Pure significance tests	77
4.4	Composite hypotheses—uniformly most powerful tests	78
4.5	Further properties of tests of hypothesis	83
4.6	Maximum likelihood ratio tests	84

4.7	Alternatives to and modifications of maximum likelihood ratio tests	89
4.8	Discussion	92
4.9	Exercises	93
5	Interval estimation	97
5.1	Introduction	97
5.2	Construction of confidence sets	98
5.3	Optimal properties of confidence sets	106
5.4	Some problems with confidence sets	108
5.5	Exercises	111
6	The decision-theory approach to inference	114
6.1	Introduction	114
6.2	Elements of decision theory	115
6.3	Point estimation	117
6.4	Loss functions and prior distributions	122
6.5	Hypothesis testing	128
6.6	Interval estimation	132
6.7	Bayesian sequential procedures	133
6.8	Exercises	144
7	Bayesian inference	151
7.1	Introduction	151
7.2	Sufficiency	151
7.3	Credible intervals	154
7.4	Hypothesis testing	158
7.5	Nuisance parameters	164
7.6	Non-informative stopping	168
7.7	Hierarchical models	170
7.8	Empirical Bayes	173
7.9	Exercises	178
8	Non-parametric and robust inference	185
8.1	Introduction	185
8.2	Non-parametric hypothesis testing	186
8.3	Non-parametric estimation	199
8.4	Goodness-of-fit tests and related techniques	201
8.5	Semi-parametric methods	203
8.6	Robust inference	204
8.7	Exercises	212
9	Computationally intensive methods	217
9.1	Introduction	217
9.2	Simulation and Monte Carlo methods	217

9.3	Permutation and randomization tests	222
9.4	Cross-validation.....	227
9.5	Jackknife and bootstrap methods	230
9.6	Gibbs sampling and related methodology	244
9.7	Exercises	256
10	Generalized linear models	265
10.1	Introduction	265
10.2	Specifying the model.....	266
10.3	Fitting a generalized linear model using maximum likelihood.....	270
10.4	Deciding if the model fits the data	278
10.5	Model checking for glms.....	287
10.6	Quasi-likelihood	295
10.7	Exercises	305
	Bibliography.....	308
	Index.....	319