

# Contents

<b>Preface</b>	<b>vii</b>
<b>1 Mathematical Background</b>	<b>1</b>
1.1 The concept of limit . . . . .	2
1.2 Embedding sequences . . . . .	8
1.3 Infinite series . . . . .	13
1.4 Order relations and rates of convergence . . . . .	18
1.5 Continuity . . . . .	26
1.6 Distributions . . . . .	30
1.7 Problems . . . . .	34
<b>2 Convergence in Probability and in Law</b>	<b>47</b>
2.1 Convergence in probability . . . . .	47
2.2 Applications . . . . .	55
2.3 Convergence in law . . . . .	63
2.4 The central limit theorem . . . . .	72
2.5 Taylor's theorem and the delta method . . . . .	85
2.6 Uniform convergence . . . . .	93
2.7 The CLT for independent non-identical random variables . . . . .	97
2.8 Central limit theorem for dependent variables . . . . .	106
2.9 Problems . . . . .	119
<b>3 Performance of Statistical Tests</b>	<b>133</b>
3.1 Critical values . . . . .	133
3.2 Comparing two treatments . . . . .	146

3.3	Power and sample size . . . . .	158
3.4	Comparison of tests: Relative efficiency . . . . .	173
3.5	Robustness . . . . .	187
3.6	Problems . . . . .	202
<b>4</b>	<b>Estimation</b> . . . . .	<b>219</b>
4.1	Confidence intervals . . . . .	219
4.2	Accuracy of point estimators . . . . .	232
4.3	Comparing estimators . . . . .	239
4.4	Sampling from a finite population . . . . .	253
4.5	Problems . . . . .	269
<b>5</b>	<b>Multivariate Extensions</b> . . . . .	<b>277</b>
5.1	Convergence of multivariate distributions . . . . .	277
5.2	The bivariate normal distribution . . . . .	287
5.3	Some linear algebra . . . . .	300
5.4	The multivariate normal distribution . . . . .	309
5.5	Some applications . . . . .	319
5.6	Estimation and testing in $2 \times 2$ tables . . . . .	330
5.7	Testing goodness of fit . . . . .	335
5.8	Problems . . . . .	349
<b>6</b>	<b>Nonparametric Estimation</b> . . . . .	<b>363</b>
6.1	$U$ -Statistics . . . . .	364
6.2	Statistical functionals . . . . .	381
6.3	Limit distributions of statistical functionals . . . . .	393
6.4	Density estimation . . . . .	406
6.5	Bootstrapping . . . . .	420
6.6	Problems . . . . .	435
<b>7</b>	<b>Efficient Estimators and Tests</b> . . . . .	<b>451</b>
7.1	Maximum likelihood . . . . .	452
7.2	Fisher information . . . . .	462
7.3	Asymptotic normality and multiple roots . . . . .	469
7.4	Efficiency . . . . .	484
7.5	The multiparameter case I. Asymptotic normality . . . . .	497
7.6	The multiparameter case II. Efficiency . . . . .	509
7.7	Tests and confidence intervals . . . . .	525
7.8	Contingency tables . . . . .	541
7.9	Problems . . . . .	551
	<b>Appendix</b> . . . . .	<b>571</b>
	<b>References</b> . . . . .	<b>591</b>
	<b>Author Index</b> . . . . .	<b>609</b>
	<b>Subject Index</b> . . . . .	<b>615</b>