

# LONG CONTENTS

List of tables and figures	xviii
Preface to the sixth edition	xxiv
Guided Tour of the Book	xxvi
Notes on the sixth edition	xxviii
Acknowledgements	xxix
<b>I MATHEMATICAL APPLICATIONS</b>	<b>1</b>
<b>1 Revision mathematics</b>	<b>2</b>
Introduction	2
Number and number operations	3
Decimals, fractions and percentages	3
Powers and roots	5
Elementary algebra	6
Indices and logs	8
Mathematical symbols	9
Graphs and straight lines	10
Solving linear equations graphically	11
Solving linear equations simultaneously	12
Inequations	12
Further reading	13
<b>2 Keeping up with change: index numbers</b>	<b>14</b>
Introduction	14
Quantitative methods in action: Is the demand for oil increasing?	15
Simple indices	16
Weighted aggregate indices	18
Consumer price indices	21
Reflection	23
Key points	24
Further reading	24
Practice questions	24
Assignment	27

<b>II</b>	<b>COLLECTING AND INTERPRETING DATA</b>	<b>29</b>
<b>3</b>	<b>Collecting data: surveys and samples</b>	<b>30</b>
	Introduction	30
	Quantitative methods in action: The Scottish referendum 2014	31
	The basics of sampling	32
	Questionnaire design	34
	Simple random sampling	37
	Stratified sampling	38
	Multi-stage sampling	39
	Cluster sampling	40
	Systematic sampling	41
	Quota sampling	41
	Other sampling methods	42
	Obtaining research data from on-line sources	43
	Reflection	44
	Key points	45
	Further reading	46
	Practice questions	46
	Assignment	49
<b>4</b>	<b>Finding patterns in data: charts and tables</b>	<b>50</b>
	Introduction	50
	Quantitative methods in action: The growth of China's economy	51
	Data classification	53
	Tabulation of data	54
	Diagrammatic representation of data	59
	Creating charts with Excel 2013	70
	Creating charts with IBM SPSS statistics	73
	Reflection	81
	Key points	82
	Further reading	82
	Practice questions	82
	Assignment	87
<b>5</b>	<b>Making sense of data: averages and measures of spread</b>	<b>88</b>
	Introduction	88
	Quantitative methods in action: How wealthy are you?	89

Measures of location	91
Measures of spread	99
Coefficient of variation	105
Box and whisker plots	106
Using Excel to calculate summary statistics	108
Using SPSS to calculate summary statistics	110
Reflection	114
Key points	114
Further reading	115
Practice questions	115
Assignment	119
<b>III PROBABILITY AND STATISTICS</b>	<b>121</b>
<b>6 Taking a chance: probability</b>	<b>122</b>
Introduction	122
Quantitative methods in action: Use of statistics in criminal cases	123
Basic ideas	125
The probability of compound events	126
Conditional probability	129
Permutations and combinations	136
Expected value	137
Reflection	138
Further reading	139
Practice questions	139
Assignment	142
<b>7 The shape of data: probability distributions</b>	<b>143</b>
Introduction	143
Quantitative methods in action: Is goal scoring a random event?	144
Discrete and continuous probability distributions	145
The binomial distribution	145
The Poisson distribution	152
The normal distribution	156
Reflection	167
Key points	167
Further reading	168
Practice questions	168
Assignment	171

<b>8 Interpreting with confidence: analysis of sample data</b>	<b>172</b>
Introduction	172
Quantitative methods in action: Using statistics to identify benefit fraud	173
Samples and sampling	175
Point estimates	176
Sampling distribution of the mean	177
Confidence intervals for a population mean for large samples	180
Confidence intervals for a population mean for small samples	182
Confidence interval of a percentage	185
Calculation of sample size	186
Finite populations	187
Reflection	188
Key points	188
Further reading	188
Practice questions	188
Assignment	190
<b>9 Checking ideas: testing a hypothesis</b>	<b>191</b>
Introduction	191
Quantitative methods in action: Are waiting times at A&E getting worse?	192
The purpose of hypothesis testing	193
Large sample test for a population mean	194
Small sample test for a population mean	198
The Z-test for a population percentage	200
Hypothesis tests involving two population means	202
Hypothesis tests involving two population percentages	209
The chi-square hypothesis test	210
SPSS and the chi-square test	216
Reflection	221
Key points	222
Further reading	223
Practice questions	223
Assignment	227
<b>10 Cause and effect: correlation and regression</b>	<b>228</b>
Introduction	228
Quantitative methods in action: Predicting time that aircraft take to taxi to the terminal building or runway	229
Scatter diagrams	231

Correlation	233
Linear regression	239
Coefficient of determination	241
Using Excel to analyse bivariate data	242
SPSS and scatter diagrams	245
SPSS and linear regression	246
Further topics in regression	247
Reflection	253
Key points	253
Further reading	254
Practice questions	254
Assignment	258

## **IV DECISION-MAKING TECHNIQUES 259**

### **11 How to make good decisions 260**

Introduction	260
Quantitative methods in action: Highway improvement project selection in Louisiana, USA	261
Problem formulation	262
Payoff tables	267
Decision trees	271
Utility	281
Multi-criteria decision-making (MCDA)	283
Reflection	292
Key points	292
Further reading	292
Practice questions	293
Assignment	299

### **12 Choosing wisely: investment appraisal 300**

Introduction	300
Quantitative methods in action: EU banks stress test	301
Measures of investment worth	302
Traditional methods for comparing projects	303
Discounted cash flow techniques	304
Other applications of the compound interest formula	311
Reflection	316
Key points	316

Further reading	317
Practice questions	317
Assignment	319
<b>13 Forecasting: time series analysis</b>	<b>321</b>
Introduction	321
Quantitative methods in action: The Ebola epidemic	322
The decomposition model	323
Isolating the trend	325
Isolating the seasonal component	328
Analysis of errors	331
Seasonally adjusted series	335
Forecasting using the decomposition model	335
Exponential smoothing	336
Using spreadsheets in time series analysis	339
Reflection	342
Key points	342
Further reading	343
Practice questions	343
Assignment	347
<b>14 Making the most of things: linear programming</b>	<b>348</b>
Introduction	348
Quantitative methods in action: Optimizing the maintenance and repair of salmon farming nets in Chile	349
Basics of linear programming	350
Model formulation	350
Graphical solution of linear programming problems	352
Tight and slack constraints	355
Sensitivity analysis	355
Minimization problems	358
Using Excel's 'Solver' to solve linear programming problems	360
Applications of linear programming	365
Reflection	375
Key points	376
Further reading	376
Practice questions	376
Assignment	383

<b>15 Planning large projects: network analysis</b>	<b>385</b>
Introduction	385
Quantitative methods in action: London's Crossrail project	386
The activity-on-node method	387
The float of an activity	390
Resource scheduling	391
Cost scheduling	393
Handling uncertainty in time estimates (the PERT method)	397
Reflection	400
Key points	401
Further reading	401
Practice questions	401
Assignment	408
<b>16 Managing stock levels: materials management and inventory control</b>	<b>410</b>
Introduction	410
Quantitative methods in action: Reloadable stored-value cards on Beijing subway system	411
Costs of holding stock	412
Economic Order Quantity (EOQ) model	412
Discounts	417
Uncertainty in demand	417
Reflection	419
Key points	420
Further reading	420
Practice questions	420
Assignment	421
Bibliography	423
Appendix: Statistical tables	424
Index	436