

5TH EDITION

Basic Business Statistics

Concepts and applications

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O'Brien Jayne Watson

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preface

This fifth Australasian and Pacific edition of *Basic Business Statistics: Concepts and Applications* continues to build on the strengths of the fourth edition, and extends the outstanding teaching foundation of the previous American editions, authored by Berenson, Levine and Szabat.

The teaching philosophy of this text is based upon the principles of the American book, but each chapter has once again been carefully revised to include practical examples and a language and style that is more applicable to Australasian and Pacific readers.

In preparation for this edition we again asked lecturers from around the country to comment on the format and content of the fourth edition and, based on those comments, the authors have worked to create a text that is more accessible – but no less authoritative – for students.

Part 5 contains additional chapters: Chapter 16 on multiple regression and model building, Chapter 17 on decision making, Chapter 18 on statistical applications in quality and productivity management, Chapter 19 on further non-parametric tests and two brand new chapters: Chapter 20 on business analytics and Chapter 21 on data analysis. This chapter will be especially useful to students who wish to understand how the concepts and techniques studied in this book all fit together. The Part 5 chapters can be found within the MyLab and student download page via our catalogue.

Chapter 21 (including Figure 21.1, which provides a summary of the contents of this book arranged by data-analysis task) is designed to provide guidance in choosing appropriate statistical techniques to data-analysis questions arising in business or elsewhere. Figure 21.1, and Chapter 21, should be referred to when working through the earlier chapters of this book. This should enable students to see connections between topics; that is, the big picture.

The new edition has continued with a ‘real-world’ focus, to take students beyond the pure theory. Some chapters have a completely new opening scenario, focusing on a person or company, which serves to introduce key concepts covered in the chapter. The scenario is interwoven throughout the chapter to reinforce the concepts to the student. Multiple in-chapter examples have been updated that highlight real Australasian and Pacific data.

The **Real people, real stats** feature that opens each of the text’s five parts is composed of a personal interview highlighting how *real* people in *real* business situations apply the principles of statistics to their jobs. The interviewees are:

- Part 1** David McCourt *BDO*
- Part 2** Ellouise Roberts *Deloitte Access Economics*
- Part 3** Rod Battye *Tourism Research Australia*
- Part 4** Gautam Gangopadhyay *Endeavour Energy*
- Part 5** Deborah O’Mara *The University of Sydney*

Judith Watson
Nicola Jayne
Martin O’Brien

acknowledgements

When developing the new edition of *Basic Business Statistics*, we were mindful of retaining the strengths of the current edition, but also of the need to build on those strengths, to enhance the text and to ensure wider reader appeal and useability.

We are indebted to the following academics who contributed to the new edition.

Technical Editor

We would like to thank Martin Firth at UWA for carrying out a detailed technical edit of the text.

Reviewers

Ms Gerrie Roberts *Monash University*

Dr Sonika Singh *University of Technology Sydney*

Dr Erick Li *University of Sydney*

Dr Amir Arjomandi *University of Wollongong*

Mr Jason Hay *Queensland University of Technology*

Mr Martin J Firth *University of Western Australia*

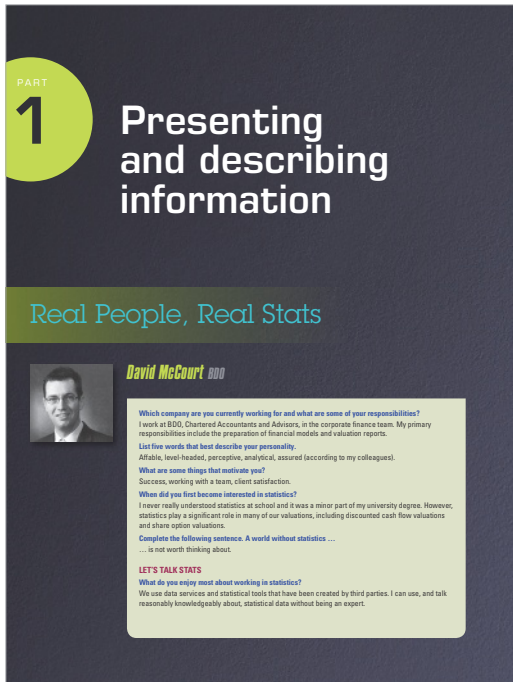
Dr Scott Salzman *Deakin University*

Ms Charanjit Kaur *Monash University*

Dr Jill Wright *Monash University*

The enormous task of writing a book of this scope was possible only with the expert assistance of all these friends and colleagues and that of the editorial and production staff at Pearson Australia. We gratefully acknowledge their invaluable contributions at every stage of this project, collectively and, now, individually. We thank the following people at Pearson Australia: Rebecca Pedley, Portfolio Manager; Anna Carter, Development Editor; Julie Ganner, Production Manager and Copy Editor; and Lisa Woodland, Rights & Permissions Team Leader.

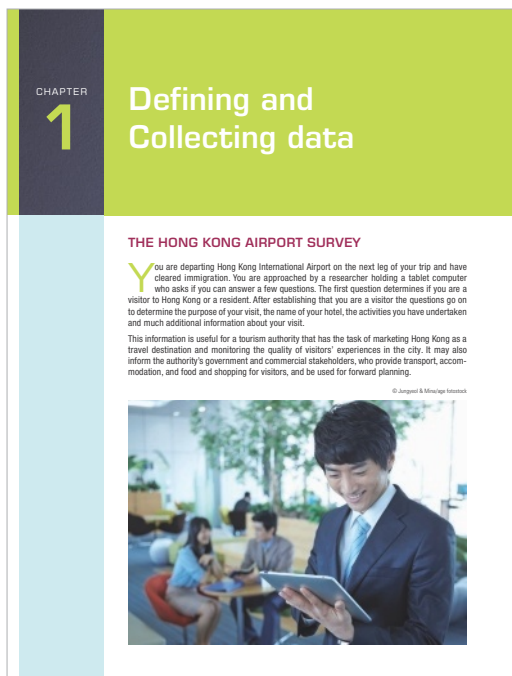
how to use this book



Real people, real stats interviews open each part. These introduce *real* people working in *real* business environments, using statistics to tackle *real* business challenges.

Learning objectives introduce you to the key concepts to be covered in each chapter, and are signposted in the margins where they are covered within the chapter.

Chapter-opening scenarios show how statistics are used in everyday life. The scenarios introduce the concepts to be covered, showing the relevance of using particular statistical techniques. The problem is woven throughout each chapter, showing the connection between statistics and their use in business, as well as keeping you motivated.



Data sets and **Excel workbooks** that accompany the text can be downloaded and used to answer the appropriate questions.

What type of chart should you use? The selection of a chart depends on your intention. If a comparison of categories is most important, use a bar chart. If observing the portion of the whole that lies in a particular category is most important, use a pie chart.

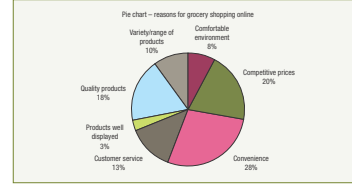


Figure 2.3 Microsoft Excel pie chart of the reasons for grocery shopping online

PIE CHART FOR FAMILY TYPE

The council and capital city demographics are presented as summary tables. Use the summary tables given for family type to construct and interpret pie charts for the capital city and the council area.

EXAMPLE 2.3

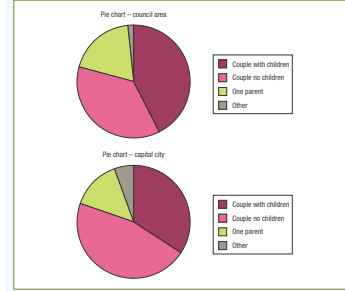


Figure 2.4 Microsoft Excel pie chart for family type

Real world, business examples are included throughout the chapter. These are designed to show the multiple applications of statistics, while helping you to learn the statistics techniques.

Emphasis on data output and interpretation

The authors believe that the use of computer software is an integral part of learning statistics. Our focus emphasises analysing data by interpreting the output from Microsoft Excel while reducing emphasis on doing calculations. Excel 2016 changes to statistical functions are reflected in the operations shown in this edition.

In the coverage of hypothesis testing in Chapters 9 to 11, extensive computer output is included so that the focus can be placed on the p -value approach. In our coverage of simple linear regression in Chapter 12, we assume that a software program will be used and our focus is on interpretation of the output, not on hand calculations.

Summaries are provided at the end of each chapter, to help you review the key content.

Key terms are signposted in the margins when they are first introduced, and are referenced to page numbers at the end of each chapter, helping you to revise key terms and concepts for the chapter.

End-of-section problems are divided into *Learning the basics* and *Applying the concepts*.

End-of-part problems challenge the student to make decisions about the appropriate technique to apply, to carry out that technique and to interpret the data meaningfully.*

Australasian and Pacific data sets are used for the problems in each chapter. These files are contained on the Pearson website.

Ethical issues sections are integrated into many chapters, raising issues for ethical consideration.

KEY TERMS 675

Assess your progress 16

Summary

In this chapter, various multiple regression topics were considered (see Figure 16.15) including quadratic regression models, interactions, transformations and model building. You have learned how suburban ratings can be used to derive a measure of income distribution. You also learned how a director of operations at a television station could build a multiple regression model as an aid to reducing labour expenses.

Key formulas

The quadratic regression model

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i}^2 + \epsilon_i \quad (16.1)$$

Quadratic regression equation

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i}^2 \quad (16.2)$$

Regression model with a square-root transformation

$$Y_i = \beta_0 + \beta_1 \sqrt{X_{1i}} + \epsilon_i \quad (16.3)$$

Original multiplicative model

$$Y_i = \beta_0 X_{1i}^{\beta_1} X_{2i}^{\beta_2} \epsilon_i \quad (16.4)$$

Transformed multiplicative model

$$\log Y_i = \log \beta_0 + \beta_1 \log X_{1i} + \beta_2 \log X_{2i} + \log \epsilon_i \quad (16.5)$$

Original exponential model

$$Y_i = e^{\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i}} \epsilon_i \quad (16.6)$$

Key terms

best-estimate approach	665	data mining	665	quadratic regression model	651
Cook's D statistic	662	hat matrix diagonal elements h_i	661	square-root transformation	657
C_p statistic	667	logarithmic transformation	658	stepwise regression	663
cross-validation	672	parimony	663	Studentized deleted residual	661

END OF PART 1 PROBLEMS 139

End of Part 1 problems

A1 A sample of 500 shoppers was selected in a large metropolitan area to obtain consumer behaviour information. Among the questions asked was, 'Do you enjoy shopping for clothing?' The results are summarised in the following cross-classification table.

Enjoy shopping for clothing	Gender		Total
	Male	Female	
Yes	138	224	362
No	104	38	140
Total	240	260	500

A2 One of the major measures of the quality of service provided by any organisation is the speed with which the organisation responds to customer complaints. A large family-held department store selling furniture and flooring, including carpet, has undergone major expansion in the past few years. In particular, the flooring department has expanded from two installation crews to an installation supervisor, a measure and 15 installation crews. During a recent year the company got 50 complaints about carpet installation. The following data represent the number of days between receipt of the complaint and resolution of the complaint.

Complaint #	Days
1	5
2	35
3	137
4	31
5	27
6	152
7	2
8	123
9	81
10	74
11	27
12	110
13	110
14	29
15	61
16	35
17	94
18	31
19	28
20	29
21	26
22	5
23	14
24	13
25	5
26	4
27	4
28	30
29	22
30	38
31	26
32	20
33	23
34	68

A3 The annual crediting rates (after tax and fees) on several managed superannuation investment funds are:

Superannuation fund	2017	2016	2015	2014	2013
Conservative	5.5	8.7	9.6	11.9	15.3
Balanced	9.5	5.2	10.7	14.1	15.9
Growth	11.8	3.8	11.3	15.6	18.7
High growth	13.7	3.1	12.3	17.4	20.5

A4 A supplier of 'Natural Australian' spring water states that the magnesium content is 1.6 mg/L. To check this, during the bottling operation the quality control department takes a random sample of 96 bottles during a day's production and obtains the magnesium content. <SPRING_WATER>

A5 The National Australia Bank (NAB) produces regular reports titled NAB Online Retail Sales Index <www.business.nab.com.au>. Download the latest 16-month report.

Problems:

- For each fund, calculate the geometric rate of return for three years and for five years.
- What conclusions can you reach concerning the geometric rates of return for the funds?
- A supplier of 'Natural Australian' spring water states that the magnesium content is 1.6 mg/L. To check this, during the bottling operation the quality control department takes a random sample of 96 bottles during a day's production and obtains the magnesium content. <SPRING_WATER>
- Construct frequency and percentage distributions.
- Construct a histogram and a percentage polygon.
- Construct a cumulative percentage distribution and plot the corresponding ogive.
- Calculate the mean, median, mode, first quartile and third quartile.
- Calculate the variance, standard deviation, range, interquartile range and coefficient of variation.
- Construct and interpret a box-and-whisker plot.
- What conclusions can you reach concerning the magnesium content of this day's production?

A6 The data in the file <WEBSTATS> represent the number of times, during August and September, that a sample of 50 students accessed the website of a statistics and they were enrolled in. For each month (August and September):

- Construct ordered arrays for August and September.
- Construct stem-and-leaf displays for August and September.
- Construct frequency, percentage and cumulative distributions for August and September.

*The solutions are calculated using the (raw) Excel output. If you use the rounded figures presented in the text to reproduce these answers there may be minor differences.

MyLab Statistics

a guided tour for students and educators

Study Plan

A study plan is generated from each student's results on a pre-test. Students can clearly see which topics they have mastered and, more importantly, which they need to work on.

Study Plan

Recommendations Progress All Chapters

Practice the sections, then take a Quiz Me to prove mastery and earn mastery points (MP).

Recommended sections

1.1 Identify the types of data used in business			
1.2 Identify how statistics is used in business			
1.3 Recognise the sources of data used in business			
1.4 Distinguish between different survey sampling methods			
1.5 Evaluate the quality of surveys			

Unlimited Practice

Each MyLab Statistics comes with preloaded assignments, including select end-of-chapter questions, all of which are automatically graded. Many study plan and educator-assigned exercises contain algorithmically generated values to ensure students get as much practice as they need.

As students work through study plan or homework exercises, instant feedback and tutorial resources guide them towards understanding.

2.1 Describe the distribution of a single categorical variable using tables and charts

Question Help

A categorical variable has four categories with the following percentages of occurrence.

Category	Percentage
A	13
B	27
C	33
D	27

- a. Construct a bar chart.
b. Construct a pie chart.

a. Choose the correct chart below.

A.
 B.
 C.
 D.

b. Choose the correct chart below.

A.
 B.
 C.
 D.

Click to select your answer and then click Check Answer.

All parts showing


Clear All

Check Answer

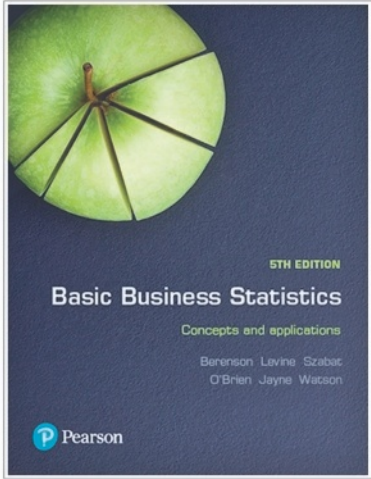
PEARSON

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 more info

- ▶ Chapter 1: Defining and collecting data
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- ▶ Chapter 5: Discrete probability distributions
- ▶ Chapter 6: The normal distribution
- ▶ Chapter 7: Sampling distributions
- ▶ Chapter 8: Confidence interval estimation
- ▶ Chapter 9: Fundamentals of hypothesis testing



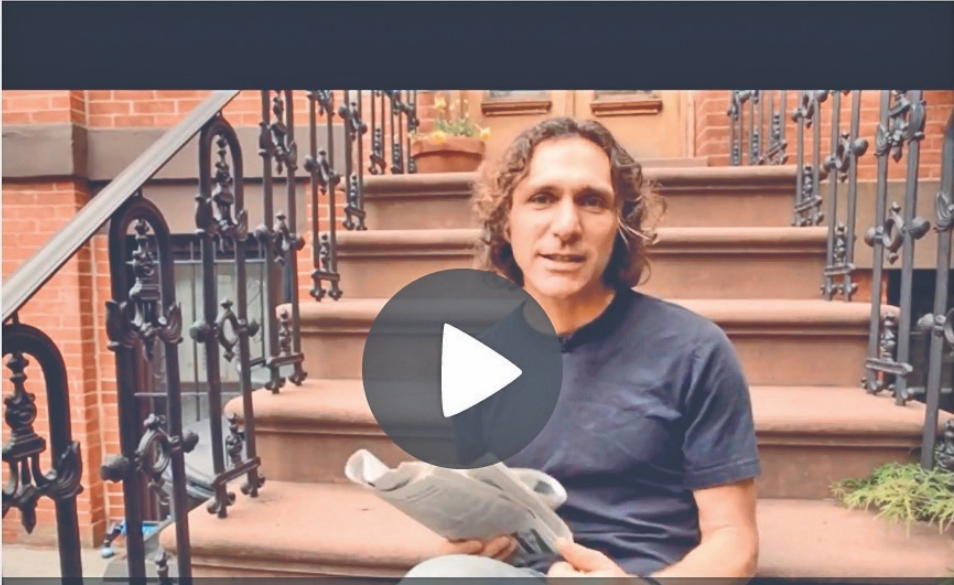
Learning Resources

To further reinforce understanding, study plan and homework problems link to the following learning resources:

- eText linked to sections for all study plan questions
- Help Me Solve This, which walks students through the problem with step-by-step help and feedback without giving away the answer
- StatCrunch.






Smart Pearson Player - Google Chrome

mediaplayer.pearsoncmg.com/assets/43GEJ1SnmkjkNLXIHGFRZY3XRU87Nt



Andrew Vickers here, Statistician at Memorial Sloan-Kettering Cancer Center.

03:43 / 04:15

info   Speed   

StatTalk Videos

Fun-loving statistician Andrew Vickers takes to the streets of Brooklyn, New York to demonstrate important statistical concepts through interesting stories and real-life events. This series of videos and corresponding auto-graded questions will help students to understand statistics.

EDUCATOR RESOURCES

A suite of resources is provided to assist with delivery of the text, as well as to support teaching and learning.

Solutions Manual

The Solutions Manual provides educators with detailed, accuracy-verified solutions to all the in-chapter and end-of-chapter problems in the book.

Test Bank

The Test Bank provides a wealth of accuracy-verified testing material. Updated for the new edition, each chapter offers a wide variety of true/false and multiple-choice questions, arranged by learning objective and tagged by AACSB standards. Questions can be integrated into Blackboard, Canvas or Moodle Learning Management Systems.

PowerPoint lecture slides

A comprehensive set of PowerPoint slides can be used by educators for class presentations or by students for lecture preview or review. They include key figures and tables, as well as a summary of key concepts and examples from the text.

Digital image PowerPoint slides

All the diagrams and tables from the text are available for lecturer use.

about the authors

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Judith Watson teaches in the Business School at UNSW Australia. She has extensive experience in lecturing and administering undergraduate and postgraduate Quantitative Methods courses.

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