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商务与法律系列
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商务决策的数量方法

(第四版)

QUANTITATIVE METHODS FOR BUSINESS DECISIONS

(FOURTH EDITION)

JON CURWIN
ROGER SLATER

世界财经与管理教材大系

东北财经大学出版社

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出 版 者 的 话

但凡成事，均缘于势。得势则事成，失势则事不顺。顺势而行，如顺水行舟；借势而动，如假梯登高；造势而为，如太空揽月。治学、从政、经商、置业，均不可一日失势。势者，长处、趋势也。

今日中国，是开放的中国；当今世界，是开放的世界。改革开放，大势所趋，势不可挡。经济开放、文化开放、政治开放，世界需要一个开放的中国，中国更要融入开放的世界。借鉴国际惯例，学习他人之长，已经到了不可不为之时。

借鉴国际惯例，学习他人之长，已属老生常谈，但学什么、如何学、以何为蓝本为众多志士仁人所关注。可喜的是，由赤诚图文信息有限公司精心策划，ITP、McGraw-Hill 及 Simon & Schuster 等国际出版公司特别授权，东北财经大学出版社荣誉出版的“世界财经与管理教材大系”现已隆重面世！她以“紧扣三个面向，精选五大系列，奉献百部名著，造就亿万英才”的博大胸襟和恢弘气势，囊括经济学、管理学、财务与会计学、市场营销学、商务与法律等财经、管理类主干学科，并根据大学教育、研究生教育、工商管理硕士（MBA）和经理人员培训项目（ETP）等不同层次的需要，相应遴选了具有针对性的教材，可谓体系完整，蔚为大观。所选图书多为哈佛、斯坦福、麻省理工、伦敦商学院、埃维商学院等世界一流名校的顶尖教授、权威学者的经典之作，在西方发达国家备受推崇，被广为采用，经久不衰，大有“洛阳纸贵”之势。

借鉴国际惯例，毕竟只是因势而动；推出国粹精品，才是造势而为。在借鉴与学习的同时，更重要的是弘扬民族精神，创建民族文化。“民族的，才是国际的”。我们提倡学他人之长，但更希望立自己之势。

势缘何物，势乃人为。识人、用人、育人、成人，乃人本之真谛。育人才、成能人，则可造大势。育人、成人之根本在教育，教育之要件在教材，教材之基础在出版。换言之，人本之基础在书本。

凡事均需讲效益，所谓成事，亦即有效。高效可造宏基，无效难以为继，此乃事物发展之规律。基于此，我们崇尚出好书、出人才、出效益！

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Quantitative methods for business decisions

Preface

Welcome to the fourth edition of *Quantitative Methods for Business Decisions*. This new edition is intended for students, from a variety of backgrounds, who find that their courses require an applied competence in mathematics and statistics. In all kinds of business-related activities the use of numbers has proved to be important and courses expect students to work with numerical representation. The power of computers is now on the 'desktop' and sets of data and sophisticated software can be easily accessed. This book intends to make a wide range of applications understandable and to give you the confidence to work with quantitative methods.

This edition includes a 'Refresher in basic numeracy skills' so that you can self-assess whether your mathematical skills are sufficient for this level of subject development or whether you need to revise some of the basic concepts and techniques. You can return to the Refresher at any point during your course to ensure that you have the foundation knowledge required. Most chapters have been substantially revised to reflect subject and course developments. There is less emphasis on working with mathematics and more on working with information and solving problems. The chapters have natural groupings of themes and these form the seven parts of the book: Quantitative Information; Descriptive Statistics; Measuring Uncertainty; Statistical Inference; Relating Variables and Predicting Outcomes; Modelling; and Mathematical Background.

Each part has an introduction to provide a context for the chapters that follow and the first six parts have an illustrative case study. The use of 'case work' has become more important in business education and students are increasingly expected to apply techniques to problems presented in this way.

This edition still includes the complementary copy of MICROSTATS by Mike Hart. This package is easy to use and will allow you to use the methods described in this book on your own sets of data. The package is similar to MINITAB and it is a matter of personal preference which package you choose to use. The use of software has transformed the application of quantitative methods, and we refer to packages like MARQUIS (for questionnaire design and analysis), SPSS and MINITAB

(for forecasting) and EXCEL (for spreadsheet solutions). You do not need access to computers to understand the contents of this book but you will need to appreciate that the use of computer software does provide the practical solution to larger, more complex problems.

Jon Curwin
Roger Slater
1996

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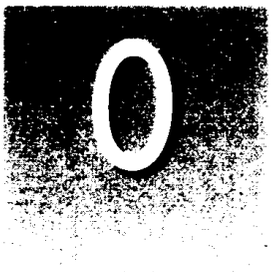
CHAPTER



A refresher in basic mathematics

People using this book are likely to come from many different backgrounds, and so we thought we would include a refresher chapter to ensure that whoever uses the book can start at about the same place.

You might want to use this chapter to pick out bits and pieces at times when you need a little extra help; or you might want to read it from the start to finish. You might be a little concerned that you have to 'do' numeracy or statistics or quantitative methods as part of your course and you may well feel that it is going to be hard work. If you are concerned, this may be a consequence of previous bad experiences with numbers. This chapter is not just about getting the 'right' answer – it is about trying to understand how to make sense of numbers and what they can tell you, or, if you prefer, about how not to get conned by other people using numbers incorrectly.

This chapter is about the basics of using numbers, calculators and computers, just to reassure you that you can actually do things with numbers. You may feel that you can skip this chapter, and if you can that is perfectly OK.

If you are not sure, try the set of short self-check tests given below.

OBJECTIVES

After working through this chapter, you will be able to:

- add numbers together;
- multiply numbers together;
- deal with brackets in numerical expressions;
- write down simple algebraic expressions;
- rearrange algebraic expressions;

- understand equations using two variables;
- use powers of numbers as a shorthand for multiplication;
- sketch simple graphs.

Part 1

Self-check tests

SELF-CHECK TEST 1: BASIC ARITHMETIC

You should not need to use a calculator to do this test!

1 $4 + 5 =$ _____
2 $12 - 8 =$ _____
3 $7 - 26 =$ _____
4 $5 \times 3 =$ _____
5 $16 \times 7 =$ _____
6 $3 \times (2) =$ _____
7 $5 \times (-2) =$ _____
8 $(-4) \times (-2) =$ _____
9 $4 + 3 \times 2 =$ _____
10 $(4 + 3) \times 2 =$ _____
11 $8 \div 2 =$ _____
12 $-12 \div 3 =$ _____

SELF-CHECK TEST 2: USE OF POWERS

You should not need to use a calculator to do this test!

1 $2 \times 2 \times 2 \times 2 =$ _____
2 $2^2 =$ _____
3 $3 + 4^2 =$ _____
4 $(3 + 4)^2 =$ _____
5 $3^3 =$ _____
6 $2^3 \times 2^4 =$ _____
7 $3^3 \div 3^2 =$ _____
8 $(4^2 - 1) \div (2^2 + 1) =$ _____
9 $\sqrt{25} =$ _____
10 $\sqrt{(7^2 - 3 \times 4 + 1)} =$ _____

SELF-CHECK TEST 3: BASIC ALGEBRA

1 If $2a = 6$, then $a =$ _____
2 If $4p = 100$, then $p =$ _____
3 If $6x + 4x = 200$, then $x =$ _____
4 If $x^2 = 49$, then $x =$ _____
5 If $4x + 5y - 4x = 25$, then $y =$ _____
6 Rearrange $6a + 3b = 12$, so that $a =$ _____
7 Rearrange $4x - 5y - 10$ so that $x =$ _____
8 If $5p^2 = 125$, then $p =$ _____
9 If $4a(2a + 3) - 8a^2 = 72$, then $a =$ _____
10 Rearrange $6s^2 + 3s = 12 + 2s^2 + (2s)^2$, so that $s =$ _____

SELF-CHECK TEST 4: GRAPHS AND MORE ALGEBRA

You will need some graph paper to answer these questions.

1 Draw a graph of $y = 2$ for values of x from 0 to 5.
2 Draw a graph of $y = 2x$ for values of x from -2 to $+5$.
3 Draw a graph of $s = 2t + 4$ for values of t from 0 to 10.
4 Draw a graph of $y = 3x - 5$ for values of x from -2 to $+10$. Find the value of y if $x = 4$.
5 Draw a graph of $y = x^2 + 2x + 1$ for values of x from -3 to $+3$.
6 Draw a graph of $y = -x^2 + 2x + 1$ for values of x from -3 to $+3$.
7 Find the roots of $x^2 - 5x + 4 = 0$.
8 Find the roots of $x^2 - 5x + 6 = 0$.
9 Find the point where the line $q = 3p + 5$ crosses the line $q = 20 - 2p$.
10 A firm has a fixed cost of £20 and a variable cost of £6 for each unit made. Given a production level of x, write down an expression for the total cost function. If the same firm can sell as many as it can make at a price of £10, and this is the only source of revenue, write down the total revenue function. Determine the production level at which the firm will break even, that is, the value of x where total cost is equal to total revenue.

SELF-CHECK TEST 5: USE OF YOUR CALCULATOR

This test is simply designed to ensure that you can use the basic functions on your calculator. Since we do not know the exact type of calculator which you have, you may want to refer to your manual if your answers do not match ours. You may also find that your calculator can perform much more complex sums that those below.

Evaluate each of the following using your calculator:

1 $100 + 527 + 93 + 14 =$ _____
2 $47 - 32 + 5 - 98.5 - 3.1 + 4.03 =$ _____
3 $27 - 4 + 348.3/7 + 4 =$ _____
4 $(27 - 4 + 348.3)/(7 + 4) =$ _____
5 $45 \times 6 \times 0.34 =$ _____
6 11% of 327 = _____
7 $\dfrac{8 \times 453 - 62 \times 9}{8 \times 724 - (62)^2} =$ _____
8 $\dfrac{89}{7} - 0.3483 \times \dfrac{58}{7} =$ _____
9 $\sqrt{(7 \times 4 + 3 \times 14)} =$ _____
10 $\dfrac{147}{\sqrt{(42 \times 729)}} =$ _____