

h Edition

Business Statistics



Fourth Edition



Fourth Edition

Business Statistics

4th edition of Business Statistics builds upon the easy-to-understand, problem-solving approach that was the hallmark of previous editions. Through detailed discussions on procedures that facilitate interpretation of data, this book enables the student to make more considered and informed business decisions.

Rich in examples of application and practice in a variety of solved examples and practice problems, this book will sharpen the students' understanding of basic statistical techniques. Business Statistics, 4e serves as a core textbook for students of management, commerce and computer science, studying business statistics for degrees in BBA/MBA/PGDBM, BCom/MCom, CA/ICWA and MCA, as well as for those preparing for professional and competitive examinations.

FEATURES

- Learning Objectives** clearly outline the learning outcomes of each chapter
- Case Studies** illustrate a variety of business situations and suggest solutions to managerial issues using specific statistical techniques
- Chapter Concepts Quiz** at the end of each chapter reinforces students' understanding of the basic principles and applications
- Conceptual Questions, Self-Practice Problems, and Review Self-Practice Problems**
- Chapter Hints and Answers** enable students, after each chapter, to practice and then evaluate themselves



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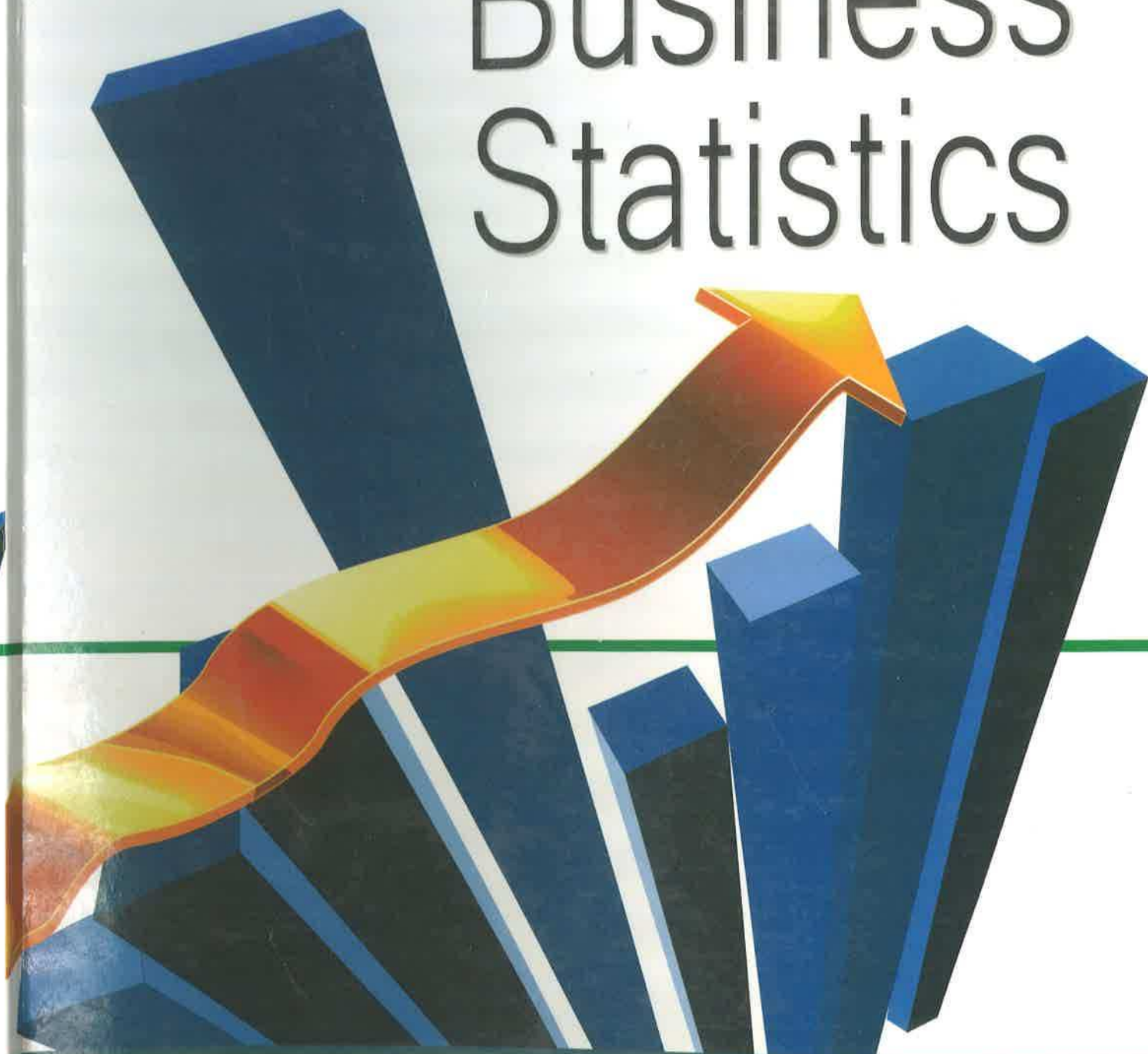
Professor Sharma is a member of several boards of studies and academic councils in India. He is actively involved in research and conducts management development programmes for both public and private sector organizations.

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Business Statistics

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VIKAS® PUBLISHING HOUSE PVT LTD

E-28, Sector-8, Noida-201301 (UP) India

Phone: +91-120-4078900 • Fax: +91-120-4078999

VIKAS® Registered Office: Vikas Publishing House Pvt. Ltd. 7361, Ravindra Mansion, Ram Nagar, New Delhi – 110 055

E-mail: helpline@vikaspublishing.com • Website: www.vikaspublishing.com

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Business Statistics
ISBN: 978-93259-8081-5

Fourth Edition 2014
Reprinted several times
First Reprint 2018

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Printed in India.

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Preface to the Fourth Edition

It gives me immense pleasure and satisfaction to present the fourth edition of *Business Statistics* to teachers and students. This edition continues to provide readers an understanding of problem-solving methods and analysis. I hope this easy-to-understand approach would enable readers to develop the required skills and apply statistical techniques to all kinds of decision-making problems.

The text has been revised in accordance with the objective of enhancing and strengthening the conceptual as well as practical knowledge of readers about various techniques of business statistics. A large number of new business-oriented solved problems as well as practice problems have been added, thus creating a bank of problems that give a better representation of the various business statistics techniques.

This edition has a complete new look and feel. The following are some of the key changes:

- The text has been reorganized and rewritten to make explanations more cogent through relevant and interesting examples. This will provide a more meaningful, easier and effective learning experience
- Each chapter contains *Learning Objectives* to guide students and help them focus their attention on understanding a specific topic
- Most of the chapters contain *Management Cases*, which help students understand various business situations and suggest solutions to managerial issues that are raised while using specific techniques of business statistics
- Each chapter contains *Concept Quizzes* to help students reinforce their understanding of the principles and applications of business statistics techniques
- Explanations are well illustrated with numerous interesting and varied business-oriented examples
- *Conceptual Questions* and *Self-practice Problems with Hints and Answers* are given in each chapter to enable students to learn at their own pace
- Complete conformity to the latest trends of questions appearing in universities and professional examinations has been maintained
- Updated questions of various Indian universities with their references have been added

The book is intended to serve as a core textbook for undergraduate students of BBA, BCA, BCom and postgraduate students of MBA/PGDBM, MCA, MCom, CA, ICWA, and for those who need to understand the basic concepts of business statistics and apply results directly to real-life business problems. The book also suits the requirement of students of AMIE who need both theoretical and practical knowledge of business statistics. It would also prove to be a great asset for those preparing for IAS, NET, ISI and other competitive examinations.

Acknowledgements

I express my heartfelt gratitude to the Founder President, Dr Ashok K Chauhan and Chancellor, Atul K Chauhan, Amity University, Noida, for their inspiration, overwhelming support and motivation.

The support of Professor B Shukla, Acting Vice-Chancellor; Professor Sanjay Srivastava, Dean, Faculty of Management, Amity University, Noida, and Professor Sanjeev Bansal, Director, Amity Business School, Amity University, Noida, was very reassuring and invaluable. I thank them from the core of my heart.

In preparing the text of this book, I have benefitted immensely by referring to many books and publications. I express my gratitude to those authors, publishers and institutions. I would also like to thank Wikipedia from where I have taken quotes that I have placed at the beginning of each chapter. If anybody has been left out inadvertently, I apologize.

I am also thankful to my esteemed colleagues and students who have contributed to this book through their valuable advice and feedback. I express my sincere thanks to Vikas Publishing House and its editorial staff. Last but not ever the least, I thank God Almighty and my family members for being there whenever I needed them.

I hope this book will serve its purpose for readers, and I will continue to get their support and suggestions. I retain the responsibility for any kind of errors in the book. I will appreciate the suggestions and comments for the improvement of the book in content and style. I can be reached at jks_sharma@yahoo.com.

J K Sharma

Preface to the First Edition

Statistical thinking enhances our understanding of how life works, allows control over some societal issues and helps individuals make informed decisions. I am sure after studying this book your skills in business decision making and understanding of the problems of business and industry will improve.

This book has been written as a practical response to the needs of students who want to obtain a reasonable grasp of basic statistical techniques or methods in a limited time. The emphasis throughout the book is on understanding through practice, interpretation of results and their application to the real-life problems. Statistical theory and derivation of formulae are deliberately kept to a minimum. This will encourage students who lack confidence in their mathematical ability to understand statistical techniques.

Each chapter of the book includes the necessary theory and methods of carrying out the various techniques and analysis. A large number of solved examples and self-practice problems (all with hints and answers) are provided to motivate students to apply statistical techniques to real data and draw statistical inferences. Other than providing useful guidance to students in several professional and competitive examinations, this book should serve as a core textbook for students of:

- BBA, BCA, BCom
- PGDBM, MBA, MCom, MA (Eco.)
- MCA, BE, BTech (Computer Science)
- CA, ICWA, AMIE

I am indebted to all my students, friends and colleagues for their helpful input while writing this book. In particular, I am thankful to Professor V K Bhalla and Professor R P Hooda for their valuable suggestions and encouragement.

In writing this book, I have benefitted immensely by referring to several books and research papers. I express my gratitude to authors, publishers and institutions of all such books and papers.

I am thankful to my wife and children for their patience, understanding, love and assistance in making this book a reality. It is to them that I dedicate this book.

Suggestions and comments to improve the book in content and style are always welcome and will be greatly appreciated and acknowledged.

J K Sharma

Table A. 12: Factors Useful in the Construction of Control Charts

Sample Size \bar{n}	Mean-Chart				Factors for Central Line		Factors for Control Limit				Factors for Central Line				Range-Chart			
	Factors for Control Limit				c_2	B_1	B_2	B_3	B_4	d_2	D_1	D_2	D_3	D_4	Factors for Control Limit			
	A	A_1	A_2	A_3											D_1	D_2	D_3	D_4
2	2.121	3.760	1.881	0.6642	0	1.843	0	3.267	1.128	0	3.686	0	3.267	0	3.686	0	3.267	
3	1.732	3.394	1.023	0.7236	0	1.858	0	2.566	1.693	0	4.358	0	2.566	0	4.358	0	2.575	
4	1.500	2.880	0.729	0.7979	0	1.808	0	2.269	2.059	0	4.698	0	2.269	0	4.698	0	2.282	
5	1.342	1.596	0.577	0.8407	0	1.756	0	2.089	2.326	0	4.918	0	2.089	0	4.918	0	2.115	
6	1.225	1.410	0.483	0.8686	0.026	1.711	0.030	1.970	2.534	0	5.078	0	1.970	0	5.078	0	2.004	
7	1.134	1.277	0.419	0.8882	0.105	1.672	0.118	1.888	2.704	2.704	5.203	0.076	1.888	0.076	5.203	0.076	1.924	
8	1.061	1.175	0.073	0.9027	0.167	1.638	0.185	1.815	2.847	2.847	5.307	0.136	1.815	0.136	5.307	0.136	1.864	
9	1.000	1.094	0.037	0.9139	0.219	1.609	0.239	1.761	2.970	2.970	5.394	0.184	1.761	0.184	5.394	0.184	1.816	
10	0.949	1.028	0.308	0.9227	0.262	1.584	0.284	1.716	3.078	3.078	5.469	0.223	1.716	0.223	5.469	0.223	1.777	
11	0.905	0.973	0.285	0.9300	0.299	1.561	0.321	1.679	3.173	3.173	5.534	0.256	1.679	0.256	5.534	0.256	1.744	
12	0.866	0.925	0.256	0.9359	0.331	1.541	0.354	1.646	3.258	3.258	5.646	0.308	1.646	0.308	5.646	0.308	1.692	
13	0.832	0.883	0.249	0.9410	0.359	1.523	0.382	1.618	3.336	3.336	5.693	0.329	1.618	0.329	5.693	0.329	1.671	
14	0.802	0.848	0.235	0.9453	0.384	1.507	0.406	1.594	3.407	3.407	5.737	0.348	1.594	0.348	5.737	0.348	1.652	
15	0.775	0.816	0.223	0.9490	0.406	1.492	0.428	1.572	3.472	3.472	5.779	0.365	1.572	0.365	5.779	0.365	1.636	
16	0.750	0.788	0.212	0.9523	0.427	1.478	0.448	1.542	3.532	3.532	5.817	0.379	1.542	0.379	5.817	0.379	1.621	
17	0.728	0.762	0.203	0.9551	0.445	1.465	0.466	1.534	3.588	3.588	5.854	0.404	1.534	0.404	5.854	0.404	1.608	
18	0.707	0.738	0.816	0.9576	0.461	1.454	0.482	1.518	3.640	3.640	5.888	0.404	1.518	0.404	5.888	0.404	1.596	
19	0.688	0.717	0.187	0.9599	0.477	1.443	0.497	1.503	3.689	3.689	5.922	0.414	1.503	0.414	5.922	0.414	1.585	
20	0.671	0.697	0.180	0.9619	0.491	1.433	0.510	1.490	3.735	3.735	5.950	0.425	1.490	0.425	5.950	0.425	1.575	
21	0.655	0.670	0.173	0.9638	0.504	1.424	0.523	1.447	3.778	3.778	5.979	0.434	1.447	0.434	5.979	0.434	1.566	
22	0.640	0.662	0.167	0.9655	0.516	1.415	0.534	1.466	3.819	3.819	6.006	0.443	1.466	0.443	6.006	0.443	1.557	
23	0.626	0.647	0.162	0.9670	0.527	1.407	0.545	1.455	3.858	3.858	6.031	0.452	1.455	0.452	6.031	0.452	1.548	
24	0.612	0.632	0.157	0.9684	0.538	1.399	0.555	1.445	3.895	3.895	6.058	0.459	1.445	0.459	6.058	0.459	1.541	
25	0.600	0.319	0.153	0.9696	0.548	1.392	0.565	1.435	3.931	3.931	6.058	0.459	1.435	0.459	6.058	0.459	1.541	

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