

## **The Concise Encyclopedia of Statistics**

Yadolah Dodge

# The Concise Encyclopedia of Statistics

With 247 Tables

 Springer

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To the memory of my beloved wife K,  
my caring mother,  
my hard working father  
and  
to my two kind and warm-hearted sons, Ali and Arash

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## Preface

With this concise volume we hope to satisfy the needs of a large scientific community previously served mainly by huge encyclopedic references. Rather than aiming at a comprehensive coverage of our subject, we have concentrated on the most important topics, but explained those as deeply as space has allowed. The result is a compact work which we trust leaves no central topics out.

Entries have a rigid structure to facilitate the finding of information. Each term introduced here includes a definition, history, mathematical details, limitations in using the terms followed by examples, references and relevant literature for further reading. The reference is arranged alphabetically to provide quick access to the fundamental tools of statistical methodology and biographies of famous statisticians, including some current ones who continue to contribute to the science of statistics, such as Sir David Cox, Bradley Efron and T.W. Anderson just to mention a few. The criteria for selecting these statisticians, whether living or absent, is of course rather personal and it is very possible that some of those famous persons deserving of an entry are absent. I apologize sincerely for any such unintentional omissions.

In addition, an attempt has been made to present the essential information about statistical tests, concepts, and analytical methods in language that is accessible to practitioners and students and the vast community using statistics in medicine, engineering, physical science, life science, social science, and business/economics.

The primary steps of writing this book were taken in 1983. In 1993 the first French language version was published by Dunod publishing company in Paris. Later, in 2004, the updated and longer version in French was published by Springer France and in 2007 a student edition of the French edition was published at Springer.

In this encyclopedia, just as with the *Oxford Dictionary of Statistical Terms*, published for the International Statistical Institute in 2003, for each term one or more references are given, in some cases to an early source, and in others to a more recent publication. While some care has been taken in the choice of references, the establishment of historical priorities is notoriously difficult and the historical assignments are not to be regarded as authoritative. For more information on terms not found in this encyclopedia short articles can be found in the following encyclopedias and dictionaries:

*International Encyclopedia of Statistics*, eds. William Kruskal and Judith M. Tanur (The Free Press, 1978).

*Encyclopedia of Statistical Sciences*, eds. Samuel Kotz, Norman L. Johnson and Cambell Reed (John Wiley and Sons, 1982).

*The Encyclopedia of Biostatistics*, eds. Peter Armitage and Ted Colton (Chichester: John Wiley and Sons, 1998).

*The Encyclopedia of Environmetrics*, eds. A.H. El-Sharaawi and W.W. Paregoric (John Wiley and Sons, 2001).

*The Encyclopedia of Statistics in Quality and Reliability*, eds. F. Ruggeri, R.S. Kenett and F.W. Faltin (John Wiley and Sons, 2008).

*Dictionnaire- Encyclopédique en Statistique*, Yadolah Dodge, Springer 2004

In between the publication of the first version of the current book in French in 1993 and the later edition in 2004 to the current one, the manuscript has undergone many corrections. Special care has been made in choosing suitable translations for terms in order to achieve sound meaning in both the English and French languages. If in some cases this has not happen, I apologize. I would be very grateful to readers for any comments regarding inaccuracies, corrections, and suggestions for the inclusion of new terms, or any matter that could improve the next edition. Please send your comments to Springer-Verlag.

I wish to thank many people who helped me throughout these many years to bring this manuscript to its current form. Starting with my former assistants from 1983 to 2004, Nicole Rebetez, Sylvie Gonano-Weber, Maria Zegami, Jurg Schmid, Severine Pfaff, Jimmy Brignony Elisabeth Pasteur, Valentine Rousson, Alexandra Fragniere, and Theiry Murrier. To my colleagues Joe Whittaker of University of Lancaster, Ludevic Lebart of France Telecom, and Bernard Fisher, University of Marseille, for reading parts of the manuscript. Special thanks go to Gonna Serbinenko and Thanos Kondylis for their remarkable cooperation in translating some of terms from the French version to English. Working with Thanos, my former Ph.D. student, was a wonderful experience. To my colleague Shahriar Huda whose helpful comments, criticisms, and corrections contributed greatly to this book. Finally, I thank the Springer-Verlag, especially John Kimmel, Andrew Spencer, and Oona Schmid for their meticulous care in the production of this encyclopedia.

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## About the Author

Founder of the Master in Statistics program in 1989 for the University of Neuchâtel in Switzerland, Professor Yadolah Dodge earned his Master in Applied Statistics from the Utah State University in 1970 and his Ph.D in Statistics with a minor in Biometry from the Oregon State University in 1973. He has published numerous articles and authored, co-authored, and edited several books in the English and French languages, including *Mathematical Programming in Statistics* (John Wiley 1981, Classic Edition 1993), *Analysis of Experiments with Missing Data* (John Wiley 1985), *Alternative Methods of Regression* (John Wiley 1993), *Premier Pas en Statistique* (Springer 1999), *Adaptive Regression* (Springer 2000), *The Oxford Dictionary of Statistical Terms* (2003), *Statistique: Dictionnaire encyclopédique* (Springer 2004), and *Optimisation appliquée* (Springer 2005). Professor Dodge is an elected member of the International Statistical Institute (1976) and a Fellow of the Royal Statistical Society.