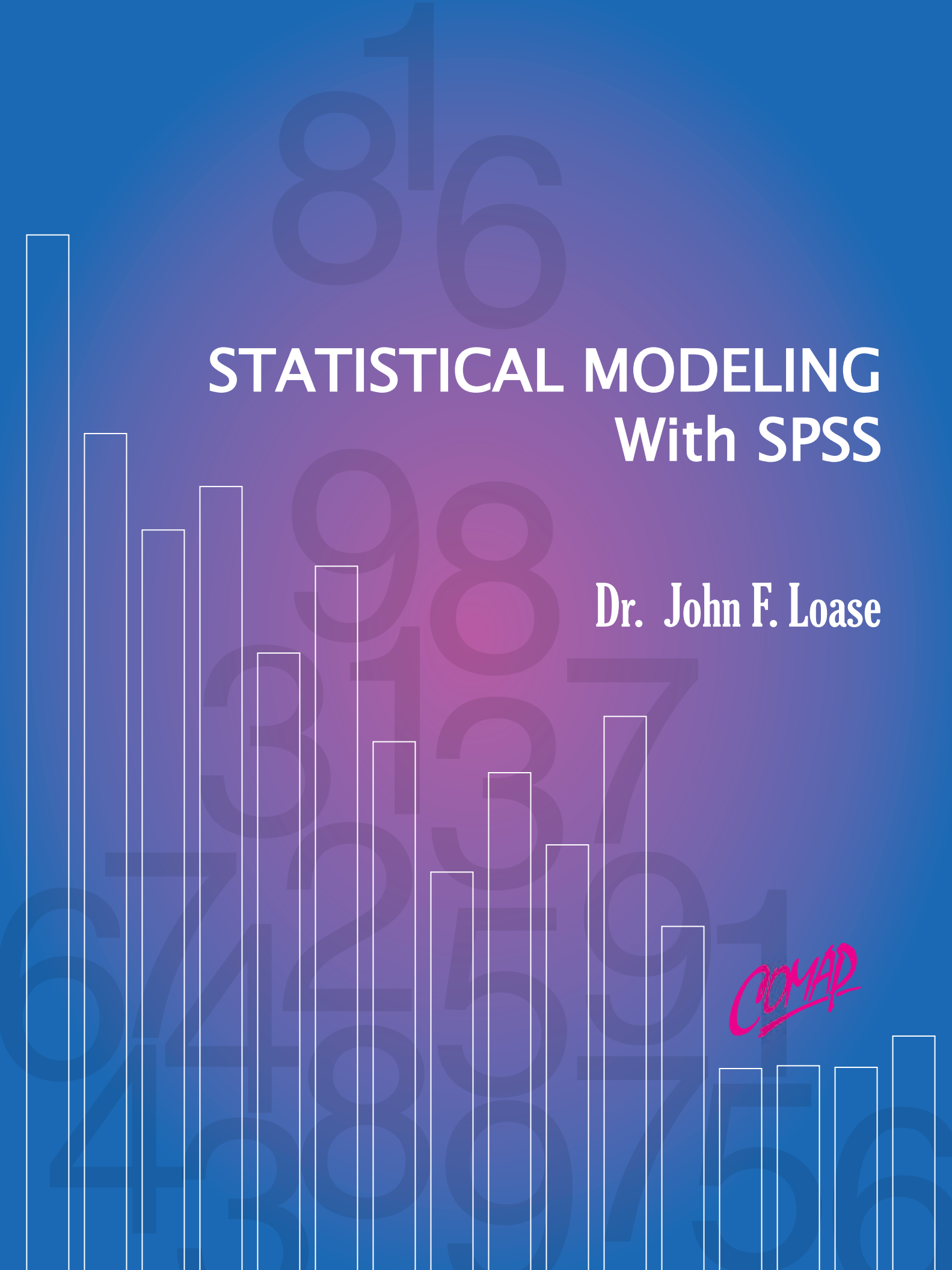

STATISTICAL MODELING With SPSS

Dr. John F. Loase

COMAP

STATISTICAL MODELING
With SPSS

Dr. John F. Loase

COMAP

STATISTICAL MODELING WITH SPSS

by Dr. John F. Loase
Concordia College, New York

Published and distributed by

COMAP, Inc.
The Consortium for Mathematics and Its Applications
170 Middlesex Turnpike, Suite 3B
Bedford, MA 01730

Support for this book was provided by:

1) This book was prepared with the support of National Science Foundation Grant # 9155966 - Mathematics Modeling. However, any opinions, findings, conclusions, and / or recemmendations herein are those of the authors and do not necessarily reflect the views of the NSF.

2) Concordia College - New York Sabbatical 2012

ISBN 1 933223 78 2

DEDICATED

TO

1) Dr. Ben Fusaro, who founded the International Contest in Mathematical Modeling and led the Advisory Council developing this book.

and

2) My late friend Burdette Graham, who lost his life in the Vietnam War.

May Mathematical Modeling unite the world's people in concern, cooperation and connection.

PREFACE

PHILOSOPHY

Statistical Modeling with SPSS is the result of over twenty years of teaching Elementary and Intermediate Statistics on the undergraduate level and Advanced Statistics and Mathematical Modeling at the graduate level.

This text has been used to prepare students for the International Contest in Mathematical Modeling and for mini-courses for college and university faculty interested in innovating mathematical modeling programs.

Statistical Modeling with SPSS was sponsored by the National Science Foundation. A distinguished advisory council and team of editors assisted with concepts and editorial suggestions throughout the book's development. They will be acknowledged at the conclusion of the preface.

PREREQUISITES

Statistical Modeling with SPSS is written as a senior level/graduate level text for mathematics, statistics, computer science or engineering majors. It reviews elementary statistics in Chapter One. The rest of the text assumes that the student has completed three semesters of Calculus, Calculus-Based Probability and Statistics, and at least one course in computer programming.

The text has been used to train students for the International Contest in Mathematical Modeling. In its early development, this book was focused on graduate level mathematical

modeling (with a statistical focus) and for advanced mathematics students preparing for the contest in modeling.

TECHNOLOGY

Statistical Modeling with SPSS makes extensive use of SPSS to test student initiated hypotheses from a set of real data included with the test. The data set is the result of coding the 104 responses (variables) of 542 undergraduates at Concordia College - NY and Iona College to the Marketing and Sigfluence Survey, included in Appendix A.

For students who need more extensive review of elementary statistics, an extensive TI-83 based Primer is included in Appendix B.

ORGANIZATION

Chapter One - Selected Topics from Elementary Statistics

A review of hypothesis testing, confidence intervals, correlation, and single variable and multiple regression analysis. An extensive review of these topics is included in Appendix B, for the interested student, geared to the TI-83 calculator.

At the conclusion of Chapter One, the student can immediately test hypotheses and perform multiple regression analyses with the enclosed set of data. Step by step instructions on the proper use of SPSS for testing hypotheses and performing regression analysis are featured in the book.

Chapter Two - Selected Topics from Calculus-Based Statistics and Probability

A review of the essential topics from Calculus Based Probability and Statistics that form the foundation of Statistical Modeling.

Chapter Three - Input Probability Distributions

Goodness of fit tests using the Poisson, normal, uniform, and exponential density functions.

The chapter concludes with SPSS exercises to test the included data set for exponential, normal, and uniform density functions.

Chapter Four - Random Number Generators

Linear congruential number theory and current research in irrational numbers as sources of random numbers.

Chapter Five - Generating Random Variables

The inverse transform method with discrete and continuous modeling examples.

A current research approach, validating multiple regression results with a statistical model, is presented together with myriad research possibilities for the student in Appendix F.

Chapter Six – Application from Linear Algebra

An applied problem from Linear Algebra solved using elementary matrix operations.

Chapter Seven - Two Modeling Exercises

Chapter Eight – Two Problems and Oustanding Solutions from the International Contest in Mathematical Modeling

Two outstanding papers are reprinted with permission of COMAP.

SPSS

One of the principal features of this book is the opportunity for students to use SPSS to analyze a 50 variable by 542 row (respondent matrix). The student should take the Marketing and Sigfluence Survey early in the course and then explore new insights into our college

students' beliefs about money and meaning. It took two years for my two graduate students, Teresa Osadnik and Grace Dickson, to enter the 104 responses for each of the 542 undergraduates who completed the survey. For the next year we deleted variables as a result of data mining and correlational methods and arrived at the 50 variable data set.

The 50 variables were all mapped to the interval (0, 1) to further explore graphical and subtle relationships. A 50 variable set has virtually unlimited potential for statistical insights. For example, there are 50 C 5 = 2,118,760 combinations of five variables we could isolate for multiple regression.

SIGFLUENCE

My doctorate was the first awarded in Mathematics (emphasis Statistics) and Psychology (Measurement, Research and Evaluation in Psychology and Education) from Columbia University Teachers College. In 1984 I invented the new word "sigfluence" to define significant, long-term, positive influence. My 8th book, *The Sigfluence Generation: Our Young People's Potential to Transform America*, is free for you to download from my website sigfluence.com. It took over 20 years of Statistical Modeling to discover that our 18-25 year olds reported dramatically high potential and need to effect sigfluence. As the book develops, you can use the data set to discover "Golden Nuggets" of significant relationships. For example, it took 18 months for my wonderful graduate students Teresa Osadnik and Grace Dickson to enter the data. Then in one afternoon, I was able to peruse 10,000 correlations that over time led to the exciting discovery that our young people can positively transform the world if we Baby Boomers serve as mentors and guides.

Statistical Modeling is foundational to recognizing and remedying real world problems. Without Statistical Modeling we rely on appearance and convenience, forever spinning our wheels in futile attempts at making the world a better place.

ACKNOWLEDGMENTS

Thanks are due Dr. Henry Ricardo (CUNY) and Professor Rowan Lindley (SUNY), who edited the test and to Professor Joyce McQuade, who completed the Solution Set. Professor Louis Rotando (SUNY) served as my mentor, department chair, and valued colleague for eighteen years.

I am especially grateful to Dr. Catherine Ricardo (Chair - Graduate Computer Science at Iona College), who offered me my first course in graduate Mathematical Modeling in 1988. We are very thankful for the leadership furthering mathematical modeling and the award of our National Science Foundation grant (1992-1996). Our distinguished advisory council provided encouragement, invaluable suggestions, and were partners in our mini-courses and lectures, which were outgrowths of the NSF grant.

Also, special recognition and deep gratitude is due Mrs. Barbara Boyce for her painstaking attention to detail and consistent loyalty for three decades of typing and editing of this, our eleventh book.

Dr. Catherine Ricardo - Iona College

Dr. Henry Ricardo - CUNY - Medgar Evars

TABLE OF CONTENTS

OVERVIEW

The reader has now reviewed elementary statistics. If more basic review of elementary statistics is useful (with specific instructions on use of the TI-83 calculator), the reader should proceed to Appendix B - a review of the essentials of a first course in statistics, TI-83 calculator based.

If the student has reviewed this material, he/she should next use SPSS to analyze the enclosed data set and perform correlational/regression analyses. SPSS (15.0) is recommended for purchase to accompany this text.

The first recommended activity is described in detail in Appendix C and uses SPSS to analyze original and current data included with your book. You should have a data set with 542 rows and 50 variables (columns). If you have reviewed your elementary statistics and understand the basics of multiple regression, proceed to Appendix C.