Preface

This book is based on notes developed for a one semester junior mathematics course at Dartmouth College. The course is a natural counterpart of the usual "Mathematical Methods of Physics" course, with techniques and applications selected from the social sciences. Since the course is frequently elected by social science majors, the prerequisites have been kept at a minimum.

It should be emphasized that this book is designed for a mathematics course, not for a course in the social sciences. The subject matter to be taught is mathematical; the problems in the social sciences are introduced only to provide motivation for learning certain techniques. In this sense, the analogy to the courses in "Mathematical Methods of Physics" is complete.

Chapter I is designed to give background information on the nature of mathematical models, and to serve as a methodological guide for the remaining chapters. It is hoped that the student will read this chapter first, and that he will return to it periodically as he progresses through the rest of the volume.

The remaining chapters are independent of each other.* The instructor may select any subset of the models for his course. Our experience indicates that a semester course can conveniently cover five or six models. Each chapter will formulate one or more problems both from the point of view of the social scientist and of the mathematician. The major part of the chapter is devoted to teaching the student the necessary mathematical techniques, and in applying them to the stated problems. Finally the results are interpreted.

The prerequisites for the course at Dartmouth consist of a year of calculus and a course in finite mathematics.† The student should be acquainted with the basic techniques of differentiating and integrating functions of one variable, and should know how to solve a very simple differential equation. In addition some elementary knowledge of probability theory and of matrix methods is assumed.

In some cases it was convenient to make use of techniques which go beyond these prerequisites; these are treated in the appendices. In each

* Except that Chapter IV should follow Chapter III.

† Based on John G. Kemeny, J. Laurie Snell, and G. L. Thompson, *Introduction to Finite Mathematics* (Englewood Cliffs, N. J.: Prentice-Hall, 1957), ch. I–V; or on John G. Kemeny and others, *Finite Mathematical Structures* (Englewood Cliffs, N. J.: Prentice-Hall, 1959), ch. 1–4.

case only a rudimentary knowledge of these more advanced methods is needed.

It is hoped that the course will not only offer a new, attractive elective for mathematics majors, but that it can form part of a two-year mathematics sequence for social science students. A year of calculus, followed by a semester of finite mathematics, followed by a course based on the present volume, should meet the minimum standards recommended for social scientists desiring to do theoretical work.

Each chapter (other than Chapter I) contains a list of exercises of varying difficulty, and suggested projects in which the student may exercise his creative ability. Several of these projects are designed to encourage the student to develop his own model, and it is hoped that better students would wish to do this to the degree of detail illustrated in the present volume. A short list of references has also been included in most of the chapters, which will, among other things, contain the works which are informally mentioned in the text.

The authors wish to express their thanks to S. Grossberg, M. W. Herriott, W. E. Marsh, and M. R. Schwartz, who—as undergraduate research assistants—contributed much to the preparation of the present volume. They also wish to thank Mrs. Margaret Andrews, Mrs. Helen Hanchett, and Mrs. Delia Pillsbury for their patient help in preparing the manuscript. The authors are also indebted to the Dartmouth College Computation Center for computing many examples.

John G. Kemeny
J. Laurie Snell

Hanover, New Hampshire