

## Preface

Mathematical sociology is not statistics. Having said that, it's a little difficult to define exactly what it is. Mathematical sociology is the use of mathematics in constructing sociological theories. Mathematics contains a rich assortment of tools for constructing mathematical models. Political sociologists, social psychologists, and sociologists who study race and ethnicity can all use mathematics in their work.

This text will contain all the mathematics it requires. Sociology is concerned with relations between sets of people. The first chapter discusses a very logical language that mathematicians have developed to describe sets, called, not surprisingly, *set theory*. It can be applied to sets of anything, but we will use it mostly to describe sets of people. Chapter II gets to the heart of the matter, characteristics of relations between people. The focus is on some of the characteristics of relations that both mathematicians and sociologists have found useful.

Mathematical sociology is, above all, sociology. Sociologists, unlike psychologists, study not just individuals, but in addition the structured patterns created by relations between people. The focus of the course is on describing and analyzing these patterns using the language of mathematics. Chapter II shows useful parallels between the language that mathematicians use to describe relations and sociological properties of relations between people. Chapter III applies some of these concepts to analyze how people use their social networks to find jobs.

Chapter IV and V introduce matrices and vectors, the major mathematical tool used in the remainder of the course. Matrices describe patterns of relations between people. Chapter VII describes properties of positive and negative (liking and disliking) relations in groups. Chapter VIII uses permutation matrices to describe marriage patterns in certain kinds of societies.

Chapters IX uses matrices to describe simple probabilistic processes in which the rows and columns of the matrix represent states of a system instead of people. Chapter X uses these models to describe influence structures within groups. Chapter XI shows how these probabilistic models are used in demography. Chapter XII through 14 presents non-cooperative and cooperative game theory and applies the latter to power within exchange networks.