# SYNOPSIS

Since this work is somewhat unusual both in content and purpose, in a field which is admittedly highly experimental, we present a short summary of the contents, purpose, and direction of each chapter.

CHAPTER 1: The essential problem of marriage theory is to characterize marriage rules and their relationships to population statistics. However, there is more than one way to do this and in chapter 1 we begin by presenting a short summary of a more standard approach to the problem than is used in the remainder of the text.

Section 1.1 summarizes a fixed class approach to subdivisions or classes in the population, and relies on relatively usual convex space methods. However, the approach does not allow a general enough conception of "marriage rule", and also ignores the large problem of the "network structure" of relationships between individuals in a population following a given rule.

Section 1.2 then discusses briefly the aims and achievements of classical demography, and points out that the areas of greatest weakness of demographic theory are precisely in interpretation and prediction of and from data such as that available in ethnographic observations.

CHAPTER 2: A considerable amount of the effort of theoretical anthropology has gone to the description of kinship systems. For the purposes of later chapters, we only need a small part of this apparatus, and we have described this part in section 2.1. A reader may therefore omit the rest of chapter 2.

However, one very large objective of this work is to argue that the proper mathematical conception of social anthropology will in fact also be a "global theory" for nearly all of the population statistics associated with human populations. Therefore, we have used up the remainder of chapter 2 to show how the apparently "trivial" results of section 2.1, when properly interpreted, can produce quite useful insights into a seemingly "established" field: population genetics. In fact, our interpretation of chapter 2 is in reality a subtle use of a continuous time sampled processes, in which we are essentially measuring differences between two points in time in the evolution of the genetic structure of a population. Where we differ from more usual models is in recognition, first, of the ability to treat the structural descriptive problem as no more than a log-transform of the statistical problem (and vice versa); and second, to place a great deal of trust in the conception of population structure as a continuous time process. In fact, although "structural" in purpose, the chapter places much more trust in this concept than do even those works whose authors' careers depend upon statistical or stochastic models.

CHAPTER 3: There are two main problem areas noted in the above synopsis of chapter 1: description of the network of social ties in a population following a given rule, and prediction of the associated statistics. Chapter 3 is devoted primarily to a framework for the network problem stated in vector space terms, but it also describes how the empirical statistics of particular networks can be computed from the network descriptions. This chapter is therefore much more descriptive and far less analytic than other sections. In a sense, it is the most optimistic of the chapters, since it provides a framework for interpretation of results not yet available.

On the other hand, the material in this chapter is not yet the final framework chosen for treatment of the problem. Therefore, since a very short summary of one use of the operators defined in chapter 3 is provided in section 4.3, a reader who finds chapter 3 obtuse or difficult, or who is not interested in the network problem, may omit it and read section 4.3 instead. Such a reader should realize that section 4.3 is more concerned with the "minimal" case, while chapter 3 is concerned with any network.

CHAPTER 4: Numerous authors have noted that various kinship and marriage rules have a smallest representation. (The introduction to chapter 3 tives a few references to these.) The problem of chapter 4 is to rigorously define a conception of "marriage rule", and to find the minimal structures associated with these rules.

It is important to note that the definition of marriage rule in this chapter is not the same as the definition of chapter 1. In chapter 1, the definition depended on (essentially) class labels; in chapter 4, the definition is in terms of "kinship ties". Actually, we are free to interpret the vocabulary of chapter 4 (since it is mathematical definition, not empirical description) in many different ways, and a very important problem arises: under what (mathematical) conditions is the framework of chapter 4 equivalent to that of chapter 1?

An intuitive answer comes from recognition that those famous "Australian systems" appear to be describable by either technique, and that furthermore, the marriage matrix of any minimal system (see chapter 3 or section 4.3) is also a permutation matrix, hence a trivial example of a marriage rule in the sense of chapter 1. However, the marriage matrix of an arbitrary population is not equivalent to the marriage rule of chapter 1, largely due to the non-uniqueness or complete absence of labels by class of persons in a system described only by kinship, since this last description is a relation between individuals. Therefore the general problem of comparing the mathematics of chapter 1 and 4 will be a problem in formal kinship: under what conditions does a kinship labeling of a population form a partition of the population which is preserved over time by the marriage system?

CHAPTER 5: The idea of preservation implies that under certain conditions, a system may not preserve itself. Chapter 4 presents one way to preserve: if a population is empirically as small as its structural minimum and follows its rules precisely so that it always forms the minimal graph, then it will also survive — with a particularly probability. Chapter 5 is devoted to computing that probability for minimal and other systems from the point of view of reliability engineering. My fondest hope is that someone will read this chapter and realize that its problem is correct but its treatment totally incorrect. Then we may hopefully have some real progress.

CHAPTER 6: We must recognize that the marriage rule and hence the structural number of a particular population following that rule may have little apparent relation to the empirical network of relations or empirical population size of the system. (Unless the empirical size is close the the minimal size!) For example, most states of the United States have a marriage law whose structural number is 4, but have population sizes in the millions. This is somewhat larger than the minimal size of eight persons per generation for a rule of number 4.

Therefore, chapter 6 is devoted to two questions: what are the average population statistics associated with a rule independently of the size of the population using the rule; and which rules does one expect to find under what conditions?

In reading the technical sections of this chapter, the reader should clearly keep in mind that the combinatorial argument given here is a "dummy variable" technique: we obtain results independent of the population size. However we also obtain strict descriptions of minimal sizes. (A useful mathematical problem would be to obtain formulae in the framework of chapter 3 which also described the expected network statistics.) We then extend the results to a much greater variety of demographic statistics and show how to interpret the U.S. Census of 1970.

CHAPTER 7: As might be expected from a final chapter, this chapter talks more of what may be possible than what has been done. It also tries to place the present work as an example of a more general class of problems in science: the relationship of structural to statistical theories.