33. **Measures of Association for Cross-Classifications.** L. A. GOODMAN AND W. H. KRUSKAL, University of Chicago.

If a population is cross-classified by two classifications, one often desires a single number which describes the degree of association between the two classifications. Given such a measure of association based upon the population proportions, one may wish to estimate it or make tests about it on the basis of a sample drawn from the population in a specified way. Standard measures of association are described and criticized. A number of other measures are suggested and motivated in the frameworks of models for predictive behavior which seem typical of the uses to which cross-classifications are put. For example, one measure is based on the relative improvement in the prediction of one classification as the other is or is not known. Also discussed are measures of partial and multiple association if there are more than two classifications. The asymptotic sampling theory for certain measures and methods of sampling is discussed.

34. **Calculating Longevities from Sample Composition.** LEO A. GOODMAN, University of Chicago.

Sometimes it is desired to compare the longevity of two or more types of equipment under operational conditions where it is not convenient to identify or keep records of individual items. Such a comparison can be made by adopting certain replacement rules and observing their effect on the composition of the population. For example, when only two types are being compared, the replacement rule might be that when an item fails, its replacement will be of the opposite type. Then the composition of the population at any time (i.e., the proportions of the different types among all the items in use) will depend upon the original composition of the population, the time elapsed, and the longevities of the different types. Since the original composition and the elapsed time are known, by determining the new composition of the population (either by total inspection or by drawing a sample from the new composition) we would expect to obtain information concerning the longevities of the different types of equipment. Replacement policies are studied which satisfy certain logistics requirements as well as the requirement that a given number of items be in operation at all times. For certain given logistics requirements, optimum replacement rules are developed. The problem of estimating and testing hypotheses concerning the relative longevities of $K \geqq 2$ types of equipment is studied for the case where the equipment is subject to a constant risk. It is then shown that if the replacement rules are used for a long period of time, the results obtained under the assumption of constant risk remain valid even when the risk is not constant as long as the equipment has a finite life span. When information about the stock is also available (i.e., how many items have been replaced), estimates and tests of hypotheses concerning the longevities of the K types of equipment are obtained. A numerical illustration is given.

NEWS AND NOTICES

Readers are invited to submit to the Secretary of the Institute news items of interest

Personal Items

Dr. M. H. Belz has now returned to the University of Melbourne after spending the first semester at Princeton. During the period of his sabbatical leave he