

Program Cover Document --- STA 304: Sampling and Nonparametric Statistics

I. Basic Course Information

STA 304 is an upper level statistics option, both for BS statistics majors and statistics minors. It is a required course for the BA Applied Statistics program. It will be scheduled for two 80-minute lecture periods. It has STA 115 or STA 215 and MAT 125 or MAT 127 as prerequisites.

II. Learning Goals

The American Statistical Association's guidelines for undergraduate programs in statistical science state that such programs should "emphasize concepts and tools for working with data and provide experience in designing data collection and in analyzing real data that goes beyond the content of a first course in statistical methods." More specifically, they recommend that programs should provide statistical topics that include random sampling, stratification in sample surveys, data exploration in observational studies, and a variety of formal inference procedures. They also recommend that programs should require familiarity with a standard statistical software package.

In everyday life and in scientific research, our knowledge, our attitudes and our actions are based to a very large extent on samples. In addition to the prominent part sampling has come to play in national decennial censuses, continuing samples are employed by government bureaus to obtain current information. Examples are the series of samples needed for the monthly Consumer Price index and also on the composition of the labor force. On a smaller scale, local governments – city, state and county – are making increased use of sample surveys to obtain information needed for future planning and for meeting pressing problems. Market research is also heavily dependent on the sampling approach.

The first half of STA 304 will cover the body of theory that has been built up to provide a background for good sampling methods. The course will then look at a variety of applications for which this theory was constructed, employing real data and authentic application areas. The course will therefore encourage synthesis of theory, methods and application, and will include critiques of some well-known misleading past surveys. There will be frequent opportunities to develop communication skills through in-class presentations of project work involving the collection and computer analysis of small-scale on-campus surveys.

Sample surveys can be classified as "descriptive" and "analytical". The latter concerns comparisons made between different subgroups of a population in order to discover whether differences exist and to form or verify hypotheses about the reason for such differences. This topic forms the bridge into the second half of STA 304, which deals with nonparametric statistics.

A large number of techniques of statistical inference have been developed which do not make numerous or stringent assumptions about the population from which

the data has been sampled. These “nonparametric” techniques result in conclusions which require fewer qualifications and they are particularly useful with small samples. It is with these techniques that the second half of STA 304 is concerned. Widely applicable and easily interpretable, the course will cover various nonparametric statistical tests in a variety of scenarios. The rationale underlying each test will be conveyed and statistical software packages such as SPSS will be used to help analyze data. Each nonparametric test will be presented according to the research design for which it is suited.

On completion of this course students should have achieved the following learning goals:

- (i) A clear understanding of the theoretical development of statistical techniques.
- (ii) The selection of appropriate techniques in given contexts.
- (iii) The skills to apply statistical procedures to a wide variety of real-life problems.
- (iv) The practice of assessing the reasonableness of analytic results.
- (v) The ability to provide correct interpretations of results and to recommend appropriate decisions.
- (vi) The possession of strong computing skills and familiarity with statistical software.
- (vii) The possession of skills directed to the communication of statistical results to a variety of audiences.

III. Student Assessment

Students will receive regular feedback on their work through the assignment of homework, quizzes, student presentations and examinations. Through this feedback, students will be able to see and correct their misunderstandings and improve their performance. Student performance on these assessment instruments and the performance of students in their other statistics options will be used to assess the success of Sampling and Nonparametric Statistics in achieving its learning goals and its contribution to the fulfillment of the MATC course program goals. Peer reviews and student evaluations will also be used to evaluate the course.

IV. Learning Activities

Learning activities will consist of a combination of lectures, group work, student presentations and computer assignments. The specific choice will depend upon the individual instructor. Outside class, students are expected to do a significant amount of individual and group homework to achieve the learning goals. These learning activities are typical of the learning activities in the MATA, MATT and MATC programs. By giving students a variety of ways and means to conduct statistical analyses, the learning activities promote a deeper understanding of the concepts of sampling and nonparametric testing and contribute to the learning goals of these programs.