

Statistics 998: Statistical Consulting

Fall 2012

Professor: Bret Larget, 1250A Medical Sciences Center (MSC).

Prerequisites: Instructor's consent.

Time and Location: Tuesdays and Thursdays, 11:00–12:15pm in 1210 MSC.

Office Hours: Thursdays, 1:00–2:30pm or by appointment. I am also typically available to talk to you right after the class.

Required Text: There are no required texts. This course will utilize the theoretical and methodological tools you acquired previously in other courses. However, many real-world consulting problems will require that you use techniques with which you may not be familiar with. Thus, you might need to spend some of your time learning new material. At the end of this document is a list of references that might be useful.

Course description: The goal of this course is to develop in each student the skills necessary for being a statistical consultant. Emphasized topics include problem solving, the connection between science and statistics, study design, data analysis, issues in data collection, both written and oral communication with scientists, practical aspects of consulting management, and ethics. The course also aims to prepare students for the masters exam in the Department of Statistics.

In-class activities: In-class activities will largely focus on class discussion with emphasis on data analysis for real problems. We will discuss report writing, oral communication, consulting management, consulting philosophy, and ethics. We will have guest lecturers, groups activities, and student presentations.

Class attendance and participation is essential. As part of two major consulting projects, scientists will come to class for interviews. Many written assignments will ask you to reflect on or explain something from the previous class period. This may be difficult or impossible if you are absent from the class.

Course Components:

- *in-class consulting projects.* Two major in-class consulting projects will be organized by the instructor. For each of these projects, the problem and data will be given to the students; a scientist will be interviewed twice by the entire class; and each student will complete the necessary analyses and write a final report. As part of the preparation for each of the interviews with scientists, students will need to write a list of at least 10 relevant questions and bring two copies of this to class—one will be handed in and the other used by the student during the interview. (You will receive more guidance on this as the interviews approach). The final report for each of these major consulting projects is worth 25% of the course grade.
- *miscellaneous writing assignments.* There will be many smaller written assignments assigned throughout the semester. On some days you will be asked to turn in a report for a common data analysis. On other days you will be asked to write a short (approximately half-page) response to a question related to the previous class period. Effective communication in writing is essential to good practice in statistical consulting. Details on assignments will be given as they are assigned. These writing assignments will be worth 25% of the course grade.
- *oral communication.* Oral communication is essential to good statistical practice. Much of the class time will be devoted to discussion. You need to participate in these discussions on a regular basis. In addition, I will frequently put students “on the spot” and ask students to stand up and address the other students in the course on a topic relevant to the course. These on-the-spot tests may be at the beginning of the class time where I ask about something from the previous class time, or may be during a class discussion. Each student will be on the spot at least once and up to two times during the course, with the order selected at random. Come to class prepared! General class discussion is worth 5% of the course grade and on-the-spot oral exams are worth 5% of the course grade.

- *final major project.* A final major consulting project will occur during the last several weeks of the semester. This project will include group work and oral and written communication. Details will follow as the semester progresses. This final project is worth 15% of the course grade.

Semester workload: The course will be "front-loaded" in that most of the work will be conducted during the first 10-12 weeks, before the masters exam. The last several weeks will be devoted mostly to the final major project with much class time devoted to this.

Academic honesty: Unless otherwise specified, you should work independently and do your own work without assistance or discussion by others. Assignments where group work or discussion is allowed will be specifically stated when the assignment is given. Given the strong importance I wish to place on ethics, I will count on you to follow the expectations that are set for the assignments.

Reference Books The following books useful for statistical consulting have been placed on reserve in the Wendt library.

- Anderson (1984), *An Introduction to Multivariate Statistical Analysis*, 2nd ed.
- Bates and Watts (1988), *Nonlinear Regression Analysis and Its Applications*
- Bishop, Fienber, and Holland (1975), *Discrete Multivariate Analysis*
- Boen and Zahn (1982), *The Human Side of Statistical Consulting*
- Box and Jenkins (1977), *Time Series Analysis, Forecasting and Control*
- Box, Hunter, and Hunter (1978), *Statistics for Experimenters*
- Chambers, Cleveland, Kleiner, and Tukey (1983), *Graphical Methods for Data Analysis*
- Chatterjee and Price (1977), *Regression Analysis by Example*
- Chatfield (1988), *Problem Solving: A Statisticians Guide*
- Cleveland (1985), *The Elements of Graphing Data*
- Cochran (1977), *Sampling Techniques*, 3rd ed.
- Cochran and Cox (1957), *Experimental Designs*, 2nd ed.
- Conover (1980), *Practical Nonparametric Statistics*, 2nd ed.
- Cox and Snell (1981), *Applied Statistics, Principles and Examples*
- Draper and Smith (1981), *Applied Regression Analysis*, 2nd ed.
- Everitt (1977), *The Analysis of Contingency Tables*
- Fienberg (1980), *The Analysis of Cross-Classified Categorical Data*, 2nd ed.
- Gnanadesikan (1977), *Methods for Statistical Data Analysis of Multivariate Observations*
- Hocking (1985), *The Analysis of Linear Models*
- Johnson and Kotz (1969–1972), four volumes on *Distributions in Statistics*
- Kalbfleisch and Prentice (1980), *The Statistical Analysis of Failure Time Data*
- Lehman (1975), *Nonparametrics: Statistical Methods Based on Ranks*
- Milliken and Johnson (1984), *Analysis of Messy Data*, Vol. 1
- Morrison (1976), *Multivariate Statistical Methods*
- Mosteller and Tukey (1977), *Data Analysis and Regression*
- Neter, Wasserman, and Kutner (1985), *Applied Linear Statistical Models*, 2nd ed.
- Scheffe (1959), *The Analysis of Variance*
- Searle (1971), *Linear Models*
- Seber (1977), *Linear Regression Analysis*
- Seber (1984), *Multivariate Observations*
- Snedecor and Cochran (1980), *Statistical Methods*, 7th ed.
- Tufte (1983), *The Visual Display of Quantitative Information*
- Tukey (1977), *Exploratory Data Analysis*
- Winer (1971), *Statistical Principles in Experimental Design*