MATH448001 Topics in Modern Statistics, MWF9 **Spring 2018**

Professor Jenny Baglivo
Voicemail: 2-3772
Email: baglivo@bc.edu

Office: Maloney Hall 574
Office Hours: M-W-F 10-11AM, 1-2PM,
and by appointment

Text: *Mathematical Statistics, and Data Analysis,* 3rd *Edition,* by John A. Rice, Duxbury Press, 2007

Course webpage:
`http://www2.bc.edu/jenny-baglivo/MT853/MT853.html`

About this class: Although statistical methods have become the analytical methods of choice in areas as diverse as biomedical and environmental sciences, geophysics, education, psychology, sociology, political science, physics, astronomy, and communications, they are often misunderstood and misused. In this course we will study intermediate statistics from several viewpoints, including classical methods, graphical methods, and modern computer-intensive methods. The multiple approach to learning should give you a deeper understanding and appreciation for the field of statistics. Applications will be emphasized.

Specific topics, and approximate times for each topic, are as follows:

1. Nonparametric, permutation and bootstrap methods (about 4 weeks),
2. Multiple sample analysis (about 3 weeks),
3. Least squares analysis (about 4 weeks), and
4. Categorical data analysis (about 2 weeks).

Readings will be from the Rice textbook, Chapters 10–14. Course notes will expand upon the readings.

Prerequisites for this course include

- A calculus-based course in probability theory at the level of MATH4426.
  (This is equivalent to topics in Chapters 1–5 of the Rice textbook.)
- A calculus-based course in statistical inference at the level of MATH4427.
  (This is equivalent to topics in Chapters 6, 8–11 of the Rice textbook.)
- Familiarity with concepts from linear algebra at the level of MATH2210.
  (In particular, matrix operations will be used to study linear least squares concepts.)
- Familiarity with using the computer to solve mathematics problems.

You should be familiar with the following concepts from probability and statistics:

> probability distributions (for example, binomial, Poisson, exponential and gaussian distributions), data summaries (for example, sample mean, sample variance, sample standard deviation, sample median), point and interval estimation methods (for example, confidence intervals for the variance of a normal distribution), the central limit theorem, maximum likelihood and likelihood ratio methods.

Readings for the course will be from the Rice textbook, Chapters 11–14. In addition, there are course notes available at the course website:

1. *Notebook 1:* The first set of course notes contains a review of probability and statistics, and reference tables for your use during the semester. I will not lecture on this material in class.

   Your first homework assignment will be to read the first set of course notes and to solve review problems based on these notes.

2. *Notebook 2:* The second set of course notes introduces nonparametric, permutation and bootstrap methods in settings that are familiar from MATH4427.

Please download the second set of course notes (*notebook2*) and bring to the next class.

3. *Notebook 3:* The third set of course notes introduces multiple sample analysis using classical methods (known as *analysis of variance*), and nonparametric and permutation methods.

4. *Notebook 4:* The fourth set of course notes introduces least squares analysis using classical methods (known as *linear regression analysis*), and permutation and bootstrap methods.

   We will use linear algebra concepts and techniques in this unit.

5. *Notebook 5:* The fifth set of course notes introduces categorical data analysis using large sample approximate methods (e.g. *the chi-square test* for contingency tables), as well as nonparametric and permutation methods.

Your final grade will be based on about nine written problem sets, class participation (totaling 70% for these two components) and one take home final project (30%). Written assignments will include problems to be solved by hand and problems to solved by computer.

I have scheduled three class sessions in a computer classroom,

Wednesday 2/14, Friday 2/16, and Monday 2/19

and I expect that we will have at least two meetings in this room. The goal of these sessions will be to familiarize everyone with the *Mathematica* (Wolfram Research Inc) programming language. At least part of every written assignment after these sessions will include computer problems.

Since most of your grade is based on work you do outside the classroom, it is important that the work you submit is yours and yours alone. I reserve the right to change to a grading policy that includes in-class tests if there are violations of this policy.

Academic integrity is central to the mission of higher education. Please observe the highest standards of academic integrity in this course. Please review the standards and procedures that are published in the university catalog and on the web, at:

`http://www.bc.edu/integrity`

Make sure that the work you submit is in accordance with university policies. If you have any questions, please consult with me. Violations will be reported to the Deans' Office and reviewed by the College's Committee on Academic Integrity. This could result in failure in the course or even more severe sanctions.