MA3631, Mathematical Statistics, 10/28/14

Term B, 2014

Class

Higgins Laboratories - HL 202, MTTF 1:00-1:50

Instructor

Balgobin Nandram

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Office Hours
Mon 9:00-9:50 & Fri 9:00-9:50

Teaching Assistant

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Office Hours
Tue 10:00-12:00 & Thu 10:00-12:00

Discussion Hours
Wednesdays (9:00-11:00, SH203)

1 Textbook

MA3631 is an introductory course in mathematical statistics. This course uses mathematics extensively, and the students are required to give mathematical proofs, clear algebraic arguments, and to combine statistical concepts. We will use the text book,

> John E. Freund's Mathematical Statistics with Applications by Irwin Miller and Marylees Miller, Prentice Hall, 8th edition, 2014.

We will cover Chapters 8, 10, 11, 12 and 13. Some of the materials will be omitted, and some new materials will be presented. To benefit from this course, students are required to have a reasonable understanding of probability theory (e.g., MA2631).

2 Course Syllabus

There are two broad areas of statistics, point and interval estimation (unbiased estimators, consistency, maximum likelihood, confidence interval) and hypothesis-testing (Neyman-Pearson lemma, likelihood ratio test, p-value, power). We need to understand the concept of sampling distributions (e.g., normal, Student's t, Chi-square and Snedecor f) to study these two areas.

About two weeks will be devoted to each of three broad sections of this course.

   a. Sampling Distributions (Ch. 8, and earlier chapters);

   b. Point and Interval Estimation (Ch. 10, 11);

   c. Hypothesis-testing (Ch. 12, 13).

A set of homework problems will be given each week; the solutions are to be turned in at the end of the week. The instructor will announce in class and on his web site when each homework assignment is due. There will be weekly quizzes. Each quiz will be administered the last 10-15 minutes on Friday's lecture. There will be two tests; the first test after the first three weeks of the term and the second test at the end of the term. A quiz will not be given during the week of a test. The homework assignments will be interfaced with the quizzes and tests.

3 Overall Goals and Expectations

Learn about the power and use of mathematical statistics. In particular,

   a. Develop some basic knowledge of mathematical statistics;

   b. Develop a toolkit of simple statistical models which are the basis for more complex models;

   c. Become a "critical thinker" about what models are applicable for a specific kind of data, although data analysis is not discussed in MA3631;

d. Learn the role of statistics in scientific investigation; in particular how to start to construct statistical models and analyze their properties;

   e. Develop the skills to perform basic activities in mathematical statistics.

4 Course Requirements

To pass this course, you must participate satisfactorily in all activities. In particular, you must

   a. Attend and actively participate in class; this includes being prepared for each day's activities (class participation will help you think more critically about the material);

   b. Read all assigned materials; in particular, read all material (see below) **before** the class in which that material will be discussed;

   c. Submit all required homework assignments;

   d. Pass both tests.

   e. Attend the discussion sessions.

5 Performance Measures

Several performance measures are used in the course. This section describes each measure and what is expected of you.

5.1 Homework

Homework is assigned for your benefit and practice. You are to use it as a yardstick to measure your understanding of the course materials. You are also expected to discuss it with your classmates as a check on your understanding. If you are not satisfied with your classmates' explanations, then you must seek help from your instructor. It is your responsibility to see that you understand the principles and ideas behind the homework exercises. A homework report is due at the end of each week. Collaboration among your classmates is encouraged so that **(up to two of you are allowed to write up a single homework report.)** Also please note that each homework exercise is worth five points; so that a homework assignment with five problems is worth 25 points. The instructor will state explicitly when a homework problem is worth more than five points. The homework problems will be assigned throughout the week because problems are assigned after the appropriate material is covered. You should be thinking and doing the homework problems continually through the week; please do not wait for the last moment. Please note that the homework problems are more extensive than the test problems. You will not be tested on the homework problems, but rather you will be tested on your general expertise in mathematical statistics. However, a good understanding of the solutions of the homework problems is mandatory.

5.2   Weekly Quizzes

The last ten to fifteen minutes of Friday's lecture will be devoted to an individual (not group) open book, open note quiz. The quiz is used to measure your knowledge of the most *recent* chapter's material. For this reason there will be *one* question which requires a good understanding of the material covered during the last few lectures and the current homework assignment.

5.3   Tests

There will be **two** open book, open note tests, based on the chapters you have completed; each test will last up to **forty-five minutes**. These tests are individual (not group) exams and involve problem solving, and not the analysis of data. Each test will consist of two to three questions, each testing the materials on one or more chapter. Very simple problems will be given to assess basic skills. The purposes of the tests are:

   a. To obtain an individual measure of your understanding of mathematical statistics;

   b. To provide an incentive for you to review the material individually.

The two tests will be given on the following dates.

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Test 1                    November  18, 2014
Test 2                    December  18, 2014
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5.4   Discussion

There will be two discussion sessions each week. These will be led by the TA. There are two aspects of these sessions. First, you can inform the TA about difficulties you are having in the course, and these are open to the class for discussion. Second, the TA can bring his own problems for discussion. He can ask you to solve a problem in the these sessions as well. No weight is attached to these activities, but you are required to attend because it is for your own benefit.

6   Communications

I will use my personal web page to communicate with you during the course. My web page is at http://www.wpi.edu/~ balnan, and all information about MA3631 will be placed under "MA3631, Mathematical Statistics". On my web page, you can find (a) the course description, (b) homework assignments, (c) general notices and (d) sometimes additional course notes. You are welcome to read about me in the rest of the web page, and you are advised to look at my web page frequently.

7 Grading

The various parts of the course are weighted as follows:

Individual Activities	Percent
Homework Sets	25
Test 1	20
Test 2	30
Quizzes	25

Grades will be assigned as follows:

Course Grades

A	At Least 85%
B	70% to 84.9%
C	55% to 69.9%

Each piece of work, you are required to turn in, will follow the same grading scheme. Usually you will be given numeric scores on each piece of work you are required to turn in; you can assign your own grades. Please note that in MA3631 the method of "grading on the curve" will not be used to adjust final grades.

8 Your Expected Time Commitment

Over twenty years ago, when the WPI Plan was conceived, it was decided to require full time students to take only three courses at a time (at other schools four or five are a full load). The rationale was that students should be more responsible for their own learning, and therefore should put in the time required to be full time learners outside of class. The figure quoted was that students should spend (on average) **seventeen hours** per week per course. **I feel that seventeen hours is a fair figure for students taking only three courses, and I expect that you to put in at least ten hours (5 in-class and at least 5 out-class) weekly in MA 3631, on average.** Of course, the well-prepared students will require fewer hours. I will put in about fifteen hours of work each week to teach you. You should attend all four lectures and a discussion session each week, and I will count these towards the time you need to work each week. You can count the time you spend thinking about MA3631 at the supermarket, baseball game etc.!

9 Disability

If you need course adaptations or accommodations because of a disability, or if you have medical information to share with me, please make an appointment with me as soon as possible; see my office hours on the first page of this document. If you have not already done so, students with disabilities, who believe that they may need accommodations in this class, are encouraged to contact the Disability Service Office (DSO) as soon as possible to ensure that such accommodations are implemented in a timely fashion. The DSO is located in the Student Development and Counseling Center, the phone number is 508-831-4908 and e-mail is DSO@WPI.EDU.

10   Academic Dishonesty

The website, http://www.wpi.edu/offices/Policies/Honesty, states "Any act that interferes with the process of evaluation by misrepresentation of the relation between the work being evaluated (or the resulting evaluation) and the student's actual state of knowledge is an act of academic dishonesty." See the website for the procedures associated with academic dishonesty.

Good Luck !!!