MA4632/MA 541 Spring 2011

Probability and Mathematical Statistics II

COURSE OUTLINE **1/18/11**

Instructor: Balgobin Nandram; V: 831-5539, F: 831-5824, E: balnan@wpi.edu

Office: SH 103; Office Hours: Mon, Tue 4-5; other times by appointment

Class SH203: Tue 5:30-6:25; 6:30-7:25; 7:30-8:25

Theme: Theory behind Applied Statistics
Goal: To understand how to construct tests and estimators, and why certain tests and estimators are most preferred in Applied Statistics.

TEXT BOOK

George Casella and Robert L. Berger (2002), **Statistical Inference**, 2^{nd} Edition, Duxbury Press, California. **The course covers Chapters 6-10.** If it becomes necessary, additional materials will be handed out.

COURSE MATERIALS

1. **Preliminaries and Introduction** [$1\frac{1}{2}$ weeks]
   (a) Sampling from a normal distribution, Section 5.3; (b) Order Statistics, Section 5.4.

2. **Principles of Data Reduction** [3 weeks]
   (a) Sufficient statistics, factorization theorem, minimal sufficiency, ancillary statistic, sufficiency principle; (b) Completeness, Basu's theorem; (c) Likelihood function, likelihood principle.

3. **Point Estimation** [$3\frac{1}{2}$ weeks]
   (a) Methods of construction; (b) Maximum likelihood estimation (MLE), Bayes estimators; (c) Evaluation of estimators: Cramér-Rao lower bound, Rao-Blackwellization - Sufficiency, unbiasedness and completeness, mean-squared error; (d) Computation using EM algorithm, Nelder-Mead algorithm, Gibbs sampler

4. **Hypothesis Testing** [3 weeks]
   (a) Methods for test construction, likelihood ratio tests, Bayesian tests; (b) Evaluation of tests, error probabilities, power function; (c) Neyman-Pearson Lemma, MP and UMP tests.

5. **Interval Estimation** [$1\frac{1}{2}$ weeks]
   (a) Methods of construction, inversion, pivotal quantities, Bayesian intervals; (b) Evaluation of intervals, coverage, unbiased, UMA; (c) Maximum likelihood intervals.

6. **Asymptotic Evaluations** [$1\frac{1}{2}$ weeks]
   (a) Point estimation; (b) Robustness; (c) Hypothesis testing; (d) Interval Estimation.

COURSE ACTIVITIES

1. **Homework Assignment**
   There will be one assignment (5-10 problems) every two weeks. You are required to write your own solutions; but you can discuss the solutions with your classmates. Most problems will be taken from the text book. It is important that you put in a great effort to solve the homework problems; they are more extensive than the tests (see below). If you are getting difficulties to solve the homework problems, it is time for you to see the instructor. A great understanding of these homework problems will give you a great performance at the tests.

   You must not copy the solution of a homework problem from somewhere else; you must provide your own solution. You must spend time reading and studying the prescribed text book. Specifically, I forbid the use of other text books in this course and the copying of materials from the internet. If you do these things, it will be a concern for academic dishonesty; see below.

   Answers to the problems will be handed out after you have turned in your own. Key points will be discussed; you may be asked to discuss the solution of an important homework problem on the chalk board.

2. **In-Class Tests**
   There will be three in-class tests; each will be given at the end of 4-5 weeks' work. They will be based on all materials covered so far with emphasis on the most recent ones. Each of the first two tests will last up to ninety (90) minutes, and the final test will last up to two (2) hours.

   The tests are designed to check your basic conceptual understanding of Mathematical Statistics. They are open-book open-notes tests; so that you will not be asked to reproduce course materials. Even though it looks like you do not need to know any course material, on the contrary you need to know the course material extremely well. If you need to open the text book or your notes during a test, it is a sign that you are not doing well.

   If it is required, there will be a 15 minutes' oral test in my office based on your performance on each test. This will be used to improve your understanding of the material and your test scores.

   If it is needed, the first two tests will be discussed with you. However, *please note that the final graded test (test 3) will not be returned to you, and it will not be discussed with you.*

Homework assignments	20	
Test I	25	Tuesday, February 15, 2011
Test II	25	Tuesday, March 22, 2011
Test III	35	Tuesday, April 26, 2011
	100	

You must participate satisfactorily in all aspects of the course.

FINAL GRADE

MA4632–A, B, C, NR; **MA541**–A, B, C, D, F
NR: 0-59; F: 0-50; D: 50-59; C: 60-69; B: 70-84; A: 85-100

ACADEMIC DISHONESTY

The web site, http://www.wpi.edu/Pubs/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 web site for the procedures associated with academic dishonesty.

Good Luck !!!