

# MA540 Mathematical Statistics

## Syllabus

### Dr. Stephan Ehrlich

#### **Brief Course Description:**

Statistics is the branch of mathematics that deals with data-based decision making based on the collection, tabulation, analysis, and interpretation of quantitative and qualitative data. This process has two separate, though linked, fundamental parts:

- Determining basic attributes (statistics) of a set of data
- Drawing conclusions from limited data samples

For our purposes, statistics will be divided into two branches: descriptive and inferential (Note - statistics also covers the design and implementation of experiments, but this is beyond the scope of this course).

Descriptive statistics in which the data is condensed and represented by metrics such as mean average and standard deviation. Inferential statistics in which deductions are made about a population based on theory such as the Central Limit Theorem and the Normal Distribution Curve.

The main function of statisticians is to provide information to those working in such diverse fields as:

- psychology, health care, environmental sciences, business, and engineering

#### **Required Text :**

Mathematical Statistics, John E. Freund, Prentice - Hall, 2001, Sixth Edition

#### **Course Objectives:**

To provide a working knowledge of the mathematical tools, language, and thought processes used by statisticians. To make you aware of the need for a precise vocabulary in any academic discipline. To enable you to incorporate statistical calculations into your arsenal of problem solving techniques.

#### **Classroom Policies:**

Students are expected to attend and participate in all classes. Attendance is taken at the beginning of each class. Please notify the instructor in advance of any anticipated absence whenever possible. It is our responsibility to make up any material missed whenever you are absent from class. Assignments are taken from exercises in the text. The homework problems are always covered in class and you are expected to read the section of text corresponding to the homework assignment. Questions about the problems should be raised at the next class meeting. The study of mathematics requires regular work and plenty of practice. Postponed homework usually results in poor comprehension and performance.

#### **Teaching Strategies:**

Lecture format, built around the textbook readings with numerous examples chosen to illustrate theoretical concepts. Lots of drill with emphasis on practice, practice, and more practice. Questions are encouraged and discussion of material stressed.

#### **Course Requirements and Grading Policies:**

Students will be evaluated based on a midterm and a final exam as follows:

- Midterm - 60%
- Final - 40%

All tests are closed book and the final is comprehensive. The results will be converted to a letter grade in keeping with grading policies of the college.

**Material Covered:**

1 - Introduction

- Review of Basic Statistical Concepts
- Combinatorial Methods

2 - Probability

- Sample Spaces and Events
- Postulates of Probability
- Conditional Probability and Baye's Theorem

5 - Special Probability Distributions (Discrete Case)

- Uniform
- Bernoulli
- Binomial
- Negative Binomial and Geometric
- Hyper geometric
- Multinomial, Multivariate, and Poisson (optional)

3 - Probability Distributions and probability Densities

- Continuous Random Variables and Probability Density Functions
- Multivariate Distributions
- Marginal and Conditional Distributions

6 - Special Probability Densities (Continuous Case)

- Uniform
- Gamma, Exponential, and Chi Square

11 - Estimation: Confidence Intervals

- Estimation of Means and Differences between Means
- Proportions, Variances

14 - Regression and Correlation by Least Square Algorithm (optional)