MATH 382 Spring 2014
Probability & Statistics

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Office Hours: Monday 8:00am-10:00am and 3:00- 4:30pm
Tuesday and Thursday 8:30-9:30am
or by Appointment

Text Book: *Lecture Notes by Hossain and Makhnin available from Math Department*

Goal: The goal of this course is to help you become familiar with the techniques, procedures and concepts of probability and statistics.

Objectives:

- To learn ideas of probability
- To learn ways to calculate in probability based models in science and engineering
- To learn basic concepts and applications of statistics
- To learn how to construct and apply probability models in science and engineering
- To learn descriptive statistics
- To learn inferences about population parameter(s)

Pre-requisites: Math 132 or equivalent passed with grade C- or better

Materials to be covered:

C**hapter 2-Lecture 1:** What is probability? Why should I study it? What are some problems, methods and examples from probability? How will this class be conducted?

Events and their Algebra:
What is needed to specify probability structures? What is sample space? Why do we need event or set algebra? What properties of events or set algebra are important for probability?

Chapter 2-Lectures 2: Probability Definitions and Rules:
What do we need to specify probability function on events? What is a probability function? How are probabilities assigned? What are some consequences of these axioms? Additive Rules
Counting Rules: Why counting rules? Tree diagram and counting rules. Permutation and combinations. Applications.

Chapter 2-Independence and Rules of Probability:
What is independence? Why is it useful? How does it contrast with mutual exclusion? What are the useful rules of probability? Multiplicative Rules.

Chapter 2-Lecture 3: Conditional probability
What is conditional probability? Why is it useful in probability assignments? Why are tree diagrams useful? What are some applications of conditioning?

Chapter 2-Lecture 4: Bayes Theorem or Bayes Rule:
What is the theorem of total probability? What is Bayes theorem? To what kinds of problems does it apply? How are tree diagrams useful here? Applications of probability and Bayes Rule.

Chapter 3-Lecture 5: Random variables and Probability distributions:
What are random variables? How is their behavior described? What are distribution and probability functions? What are their properties?

Chapter 3-Lecture 6: Expected Values : What are the mean, variance and standard deviation of a discrete random variable? What are the useful properties?

Chapter 3-Lecture 7: Some Discrete Probability Distributions:
Bernoulli, Binomial, geometric, and Poisson distributions:
What are the assumptions of the distributions? What are the mean and variances of the distributions?

Chapter 3-Lecture 8: Hypergeometric, Negative Binomial and Geometric Distributions:
What is the Negative Binomial distribution? When is it applied? What are the mean and variances of the above distributions?

Chapter 4-Lecture 9: Continuous Random variables:
What is a continuous Random variable? How is it described? What is a probability density function? What are the measures of continuous random variables?

Chapter 4- Lecture 10: Some continuous distributions:
What is uniform distribution? What is the exponential distribution? When are they used? What is a gamma random variable and what are its properties?

Chapter 4-Lecture 11: Normal Random Variable:
What is a standard normal density? What are the mean and variance of a normal distribution? How are probabilities calculated for normal random variables? What are some applications of the Normal Distribution? What are ways to check Normality? What is a Q-Q plot and how is it used? Normal approximation to the Binomial.

Chapter 4-Lecture 12: Chi-Squared & Weibull Distributions.

Chapter 4-Lecture 13: Moment generating functions:
How are moments generating functions defined for continuous case? What are some common moment generating functions**?**

Chapter 5-Lecture 14: Joint random variables:
How is the behavior of several random variables described? What are the joint distribution functions and joint probability density functions? How are they related and how are probabilities calculated? What are the conditional probability functions? What are the marginal probability densities? What are the conditional probability densities?

Chapter 5-Lecture 15: Expected Values and properties:
How are the expected values of functions of several random variables defined? What is the covariance between two random variables? What is correlation coefficient? What is a conditional expected value. What are some important properties of conditional expectations?

Chapter 6-Lecture 16: Functions of random variables:
How can we treat functions of random variables? What is the method of distribution functions? What is the method of transformation? Why is the sum of the random variables important? What are the limiting properties of probabilities?

Chapter 7-Lecture 17: Sampling distributions:
What is the Central limit Theorems? How is it applied? T-distribution & F-distribution

Chapter 8 -Lecture 18: Estimation and hypothesis testing:
Point and interval estimates for large and small samples. Paired observations. Estimating proportion.

Chapter 8-Lecture 19: one and two sample tests:
General concepts of hypotheses. One and two tailed tests. Concept of two types of errors. Concepts of P-value. Test of hypotheses for mean(s) for large and small samples. Inference of dependence data (Paried t-tests (correlated data)). Inferences using two independent population means.

Chapter 8-Lecture 20: Inference for population proportion(s):
Confidence interval for population proportion and test of hypothesis for proportion P. Inferences for two population proportions.

Chapter 9-Lecture 21: Linear regression & Correlation:
What is a least squares method? Some discussion and assumptions. Correlation analysis and residual analysis. How do you predicted a value using least square technique?

Chapter 10-Lecture 22: Categorical Data Analysis

COURSE POLICY:

You are encouraged to seek help from the instructor. Your course grade will be determined on the basis of combined scores from Homework, in class tests and final exams. In order to make up any assignment, a valid excuse should be documented. The instructor decides if an excuse is a valid one.

Exams: There will be two in class tests which will be announced one week ahead of time.
Homework: All homework is due at the beginning of the lecture (the day it's assigned).

Grading is based on the percentage of total points earned (the individual tests, homework etc. are not assigned a letter grade).

Distribution of points:		
	Homework	20%
	In class Tests	40%
	Final	40%
	Total	100%

Grading Scale (tentative): A: 90-100%; B: 80-89; C: 70-79; D: 60-69; F: < 60
The instructor reserves the right to change any part of this syllabus as he sees fit.

YOU ARE RESPONSIBLE FOR ALL MATERIAL ASSIGNED IN THE TEXT AND ALL THE MATERIAL IN CLASS. REGULAR CLASS ATTENDANCE IS STRONGLY RECOMMENDED. THE COURSE IS A CUMULATIVE COURSE- FOR THIS REASON DO NOT FALL BEHIND AND ALWAYS DO THE HOMEWORK!

MATH 382 HOMEWORK PROBLEMS FOR SPRING 2014

HW#1: **2.2, 2.4, 2.5, 2.6, 2.8, 2.9, 2.12, 2.13**
HW#2: **2.17, 2.18, 2.19, 2.23, 2.24, 2.25, 2.27, 2.29**
HW#3: **2.33, 2.34, 2.36, 2.37, 2.40, 2.43**
HW#4: **2.47, 2.48, 2.50, 2.52, 2.53, 2.54, 2.55**
HW#5: **3.2, 3.3, 3.5, 3.6, 3.8, 3.12, 3.13, 3.15**
HW#6: **3.18, 3.19, 3.23, 3.24, 3.25, 3.28, 3.32**
HW#7: **3.34, 3.36, 3.38, 3.39, 3.43, 3.45, 3.46, 3.51**
HW#8: **3.52, 3.53, 3.54, 3.56, 3.57, 3.58, 3.59**
HW#9: **4.1, 4.2, 4.5, 4.6, 4.8, 4.10, 4.12, 4.13**
HW#10: **4.17, 4.18, 4.19, 4.23, 4.24, 4.25, 4.27**
HW#11: **4.30, 4.31, 4.33, 4.39, 4.40**
HW#12: **5.2, 5.3, 5.4, 5.6, 5.9, 5.11**
HW#13: **6.2, 6.10, 6.12, 6.13, 6.18, 6.19, 6.21**
HW#14: **8.3, 8.4, 8.10, 8.11, 8.15, 8.18, 8.22, 8.24**
HW#15: **8.28, 8.29, 8.30, 8.32, 8.33, 8.35, 8.37**
HW#16: **9.2, 9.3, 9.4, 9.5, 9.6, 9.7**