

## MATH 3410 - Principles of Probability and Statistics

**Course Description:** Summary and display of data; basic probability concepts; discrete distributions; continuous distributions; computer-aided probabilistic and statistical modeling of real problems; estimation; tests of statistical hypotheses.

**Prerequisite:** C or better in MATH 2320.

**Schedule:** Fall, Spring. 3 credit hours.

**Textbook:** Hogg, R.V. and Tanis, E.A., *Probability and Statistics Inference*, 7<sup>th</sup> edition. Prentice Hall.

**Topic covered:** In this course, we will cover chapters 1, 2, 3, 5, 6 and 8.

After this course, you should know:

- .Summary and display of data;
- .Basic probability concepts;
- .Knowledge of discrete distributions; continuous distributions;
- .Knowledge of the normal distribution;
- .Estimation and testing of statistical hypotheses.

### Chapter 1: Probability

Basic Concepts  
Properties of Probability  
Methods of Enumeration  
Conditional Probability  
Independent Events  
Bayes' Theorem

### Chapter 2: Discrete Distributions

Random Variables of the Discrete Type  
Mathematical Expectation  
The Mean, Variance, and Standard deviation  
Bernoulli Trials and the Binomial Distribution  
The Moment-Generating Function  
The Poisson Distribution (if time permits)

### Chapter 3: Continuous Distributions

Continuous-Type Data and EDA  
Random Variables of the Continuous Type  
The Uniform and Exponential Distributions  
The Gamma and Chi-Square Distributions  
Distributions of Functions of a Random Variable  
Additional Models (if time permits)

## **Chapter 5: The Normal Distribution**

A Brief History of Probability

The Normal Distribution

Random Functions Associated with Normal Distributions

The Central Limit Theorem

Approximations for Discrete Distributions

The Bivariate Normal Distribution

Limiting Moment-Generating Functions

Importance of Understanding Variability (The textbook does not have this section)

## **Chapter 6: Estimation**

Sample Characteristics

Point Estimation

Sufficient Statistics

Confidence Intervals for Means

Confidence Intervals for Difference of Two Means

Confidence Intervals for Variances

Confidence Intervals for Proportions

Sample Size

Order Statistics

Distribution-Free Confidence Intervals for Percentiles

A Simple Regression Problem

More Regression

Resampling Methods (if time permits)

Asymptotic Distributions of Maximum Likelihood Estimators

## **Chapter 8: Tests of Statistical Hypotheses**

Tests About Proportions

Tests About One Mean and One Variance

Tests of the Equality of Two Normal Distributions

The Wilcoxon Tests

Chi-Square Goodness of Fit Tests

Contingency Tables

One-Factor Analysis of Variance

Two-Factor Analysis of Variance

Tests Concerning Regression and Correlation

Kolmogorov-Smirnov Goodness of Fit Test

Run Test and Test for Randomness (if time permits)