MATH 1550 STATISTICAL ANALYSIS I

3 Credits
Offered in Lecture Format
Prerequisite required (MATH 1200 or 1700 with a grade of C or better or Appropriate Placement-Test Score)

SYLLABUS

I. GENERAL CONCEPTS

A. Population and samples
   1. Census vs. sampling study
   2. Types of samples

B. Random variable
   1. Discrete and continuous
   2. Numeric and non-numeric

C. Measuring scales
   1. Nominal
   2. Ordinal
   3. Interval
   4. Ratio

II. PRESENTATION OF DATA

A. Stem and leaf plot
B. Single and many value classes
C. Frequency distributions and histograms
D. Relative, cumulative and relative cumulative frequency tables
E. Shape, center, dispersion, skewness, kurtosis and presence of outliers by observation only

III. CONDENSATION OF DATA

A. Measures of central tendency
   1. Mean
   2. Median
   3. Mode
   4. Advantages and disadvantages of each
   5. Weighted means

B. Measures of dispersion
   1. Range
   2. Mid range
   3. Standard deviation

C. Distribution of values in a data set
   1. Chebyshev's inequality
   2. General rule (68%, 95%, 99^{+}%)
   3. Standardized values
   4. Identification of outliers using numerical criteria

D. Grouped data
   1. Measures of center
   2. Measures of dispersion
   3. Percentiles

IV. PROBABILITY

A. Probability terms
   1. Experiment
   2. Trial
   3. Outcome
   4. Sample space
   5. Event
B. Definition of probability
   1. Relative frequency
   2. Axiomatic (mathematical)
C. Elementary laws of probability
D. Conditional probability
E. Counting techniques
   1. Fundamental counting principles
   2. Permutations
   3. Combinations
   4. Probability problems
F. Probability trees
G. Contingency tables

V. PROBABILITY DISTRIBUTIONS OF DISCRETE RANDOM VARIABLES

A. General probability distributions
   1. Form
      a. Table
      b. Graph
   2. Computation of probabilities using table
B. Definition of mean (expected value) and variance
C. Binomial distribution
   1. Mean
   2. Variance
D. Poisson distribution
   1. Mean
   2. Variance
E. Sample mean
   1. Mean
   2. Variance
   3. Standard error of estimate
F. Sample proportion
   1. Mean
   2. Variance

VI. DISTRIBUTIONS OF CONTINUOUS RANDOM VARIABLES

A. Introduction to continuous distributions
B. Normal distributions
   1. Properties
   2. Parameters μ and σ
C. Standard normal distributions
   1. Use of normal tables
   2. Percentiles of Z distribution
D. Transformations to and from standard normal
E. Percentiles of normal distribution
F. Determination of outliers
G. Estimates and their properties
   1. Sample mean
   2. Sample variance

VII. DISTRIBUTION OF SAMPLE MEAN

A. Distribution of $\dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$
   1. Sampled population is normal - non-normal
      a. σ known
      b. σ unknown
      c. Sample size (small, large)
      d. Z, t distribution
         1. degrees of freedom
      e. Central limit theorem

VIII. CONFIDENCE INTERVAL ESTIMATES OF μ

A. Normal population - non normal population
   1. σ known
   2. σ unknown
   3. Sample size (small, large)
B. Minimum sample size problems
   1. Optimization problems: cost analysis
   2. Pilot studies
C. C.I. estimate of Population Proportion

IX. HYPOTHESIS TESTING: ONE POPULATION

A. Hypothesis test about μ
   1. Test statistic
   2. Level of significance $\propto$, % (P-number)
      a. One-tailed test
      b. Two-tailed test
   3. Type I error
   4. Type II error
   5. Relationship between the selection of H_o and Type I error
   6. Analysis of the implications of an accepted or rejected null hypothesis

B. Hypothesis test about σ^2: Chi-squared (χ^2) Distribution

X. HYPOTHESIS TESTING: TWO POPULATIONS

A. Difference in means
   1. Dependent samples - pairing technique
   2. Independent samples - grouping technique
      a. σ known
      b. σ unknown
      c. Sample size (small, large)

XI. HYPOTHESIS TESTS ABOUT THE INDEPENDENCE OF TWO CLASSIFICATIONS AND GOODNESS OF FIT

A. Contingency table

B. χ^2 Distribution

C. Interpretation

XII. SIMPLE LINEAR CORRELATION AND REGRESSION ANALYSIS

A. Correlation
   1. Scatter plot
   2. Pearson's coefficient of correlation
   3. Pearson's coefficient of determination
   4. Testing for the significance of correlation

B. Regression Model: $Y = \alpha + \beta x$
   1. Least squares estimates a and b
   2. Prediction equation
   3. Standard error of estimate