Math 1175C: Statistics for the Health and Social Sciences

Credit hours: **3 credits**
Prerequisites: **Placement in ACCUPLACER Grid 2 or MATH 0099 with a grade of C or better**
**** Math 1175C: Statistics for the Health and Social Sciences with MATH 0275C: Support for Statistics for the Health and Social Sciences**

Course Description

Statistical procedures required for the analysis of data are explored using data acquired from a variety of sources including fields in the health and social sciences. Statistical packages may be employed as a tool.

Course Objectives

1. Form a firm foundation in the basics of sampling and data presentation
2. Analyze and interpret data within various fields including the Health and Social Sciences
3. Employ fundamental concepts of probability within the context of data sets and probability experiments

Learning Outcomes

1. Understand data collection, types of variables, levels of data, and sampling methods
2. Use a statistical package to enter, organize, and edit data
3. Create and interpret bar graphs, histograms, circle graphs, frequency distributions, relative frequency distributions, stem-and-leaf plots, boxplots, and other tables, graphs, and distributions
4. Compute and interpret measures of central tendency, standard deviation, and z-scores
5. Determine outliers by formula (e.g. upper fence, rule of thumb) and recognize them within distributions
6. Apply the language and concepts of probability in a variety of settings
7. Compute empirical and classical probabilities using the rules of probability and/or counting techniques
8. Employ the standard normal distribution to interpret area under a normal curve, compute probabilities percentiles for normally distributed random variables over various intervals
9. Estimate population parameters with confidence intervals and interpret the results
10. Perform hypothesis tests involving one population parameter and interpret the results
11. Use simple linear regression analysis to discover trends within scatter plots and predict outcomes with the least-squares regression line

Course Topics

I. GENERAL CONCEPTS
- A. Populations and samples
  1. Census vs. sampling study
  2. Sampling methods
  3. Types of bias
- B. Variables
  1. Qualitative vs. quantitative
  2. Discrete vs. continuous
- C. Levels of data
  1. Nominal
  2. Ordinal
  3. Interval

4. Ratio

II. PRESENTATION OF DATA
- A. Stem and leaf plot
- B. Boxplot
- C. Other presentations (e.g. pie chart) and misrepresentations
- D. Classes
- E. Frequency distributions and histograms
- F. Relative frequency, cumulative and relative cumulative frequency distributions
- G. Shape, center, dispersion, skewness, kurtosis and the presence of outliers via observation only

III. DESCRIPTIVE STATISTICS
- A. Measures of central tendency
  1. Mean
  2. Median
  3. Mode
  4. Midrange
  5. Advantages and disadvantages of each measure of center
  6. Weighted means
- B. Measures of dispersion
  1. Range
  2. Variance
  3. Standard deviation
- C. Distribution of data
  1. Chebyshev's Inequality
  2. Percentiles
  3. Normal distributions and the Empirical Rule
  4. Z-scores
  5. Identifying outliers numerically
- D. Grouped data
  1. Measures of center
  2. Measures of dispersion

IV. PROBABILITY
- A. Vocabulary
  1. Experiment
  2. Trial
  3. Outcome
  4. Sample space
  5. Event
- B. Types of probability
  1. Empirical
  2. Classical
  3. Subjective
- C. Basic and general rules of probability
- D. Conditional probability
- E. Counting techniques
  1. Fundamental counting principles
  2. Permutations
  3. Combinations
  4. Probabilities involving counting techniques
- F. Probability trees
- G. Contingency tables

V. DISTRIBUTIONS OF DISCRETE RANDOM VARIABLES

- A. Probability distributions
  1. Graphs
  2. Tables
  3. Outliers
- B. Discrete random variables
  1. Expected value (mean)
  2. Variance
  3. Standard deviation
  4. Computations including “at most” and “at least” probabilities
- C. Binomial experiments
  1. Expected value (mean)
  2. Variance
  3. Standard deviation
  4. Computations including “at most” and “at least” probabilities

VI. DISTRIBUTIONS OF CONTINUOUS RANDOM VARIABLES

- A. Introduction to continuous distributions
- B. Normal distributions and the bell curve
  1. Properties
  2. Graphs
  3. Standard normal density curve table
  4. Percentiles and z-scores
  5. Transformations to and from z-scores
  6. Computations including “at most” and “at least” probabilities
  7. The normal approximation to the binomial probability distribution
- C. Determination of outliers

VII. DISTRIBUTION OF THE SAMPLE MEAN AND SAMPLE PROPORTION

- A. Sampling distributions
- B. Distribution of the sample mean
  1. Standard error of the mean
  2. Central Limit Theorem
  3. Conditions for normality
- C. Distribution of the sample proportion
  1. Standard deviation
  2. Conditions for normality

VIII. CONFIDENCE INTERVALS

- A. Point estimates
- B. Margin of error factors
- C. Level of significance and level of confidence
- D. Estimating a population proportion
  1. Verification of normality
  2. Constructing a confidence interval
  3. Interpretation
  4. Sample size necessary for a specified error
- E. Estimating a population mean
  1. Student’s t-distribution
     a. Properties
     b. Degrees of freedom
     c. Table
  2. Constructing a confidence interval
  3. Interpretation

4. Sample size necessary for a specified error

IX. HYPOTHESIS TESTING: ONE POPULATION

- A. Null hypothesis
- B. Alternative hypothesis
- C. Type I error
- D. Type II error
- E. P-value
- F. Statistical significance vs. practical significance
- G. Testing a population proportion
    1. Notation
    2. Critical values
    3. Classical approach vs. p-value approach
    4. Interpretation
- H. Testing a population mean
    1. Notation
    2. Critical values
    3. Classical approach vs. p-value approach
    4. Interpretation

X. SIMPLE LINEAR CORRELATION AND REGRESSION ANALYSIS

- A. Correlation
- B. Scatter plot
    1. Positive association
    2. Negative association
- C. Sample linear correlation coefficient r
    1. Properties of r
    2. Testing for the significance of correlation
- D. Least squares regression model
    1. Interpreting slope and intercepts
    2. Graphs
    3. Using the least squares regression model
    4. Standard error