

STA 291 Course Outline

- I. Understanding Statistics
 - A. Define statistics
 - B. Understand that statistics is used to make relevant decisions
 - C. Understand the distinction between statistical science and the reporting of numerical facts

- II. Experiments & Observational Studies
 - A. Random Variables
 - 1. Determine categorical and measurement variables
 - 2. Determine continuous and discrete variables
 - 3. Identify experimental variables
 - a. Response
 - b. Explanatory
 - c. Confounding
 - d. Interacting
 - e. Extraneous factors
 - B. Experiments - Understand and identify use of the following elements:
 - 1. Treatments
 - 2. Control groups, placebo and placebo effect
 - 3. Experimental Design
 - a. Block design
 - b. Randomized comparative design
 - c. Matched-pair design
 - 4. Randomization
 - 5. Causation
 - C. Observational Studies - Understand and identify use of the following elements:
 - 1. Types of observational studies
 - a. Case-control study
 - b. Retrospective study
 - c. Prospective study
 - 2. Efficacy

- III. Sampling - Indicate knowledge of purpose and importance of random sampling, demonstrate various sampling methods
 - A. Terminology
 - 1. Population
 - 2. Sampling frame
 - 3. Sample

- B. Margin of Error
- C. Sampling methods
 - 1. Simple Random Sampling
 - 2. Stratified Random Sampling
 - 3. Other Sampling Methods
- D. Sampling variability
 - 1. Behavior of sample proportions
 - 2. Behavior of sample means

IV. Descriptive Statistics

- A. Statistic vs. Parameter - Define and understand statistic and parameter
- B. Measures of central tendency - Determine when use is appropriate and compute
 - 1. Mean
 - 2. Median
 - 3. Mode
- C. Measures of variability - Understand relationship and purpose, and compute using technology after achieving understanding
 - 1. Variance
 - 2. Standard deviation
 - 3. Quartiles
- D. Graphical Displays
 - 1. Displays for Measurement Data - Understand and determine appropriateness, draw graphs, and make conclusions
 - a. Histogram
 - b. Stemplot
 - c. Boxplot
 - d. Scatterplot
 - e. Line Graph
 - 2. Displays for Categorical Data - Understand and determine appropriateness, draw graphs, and make conclusions
 - a. Frequency distributions
 - b. Bar graph
 - c. Pie chart

V. Inferential Statistics

- A. Confidence Intervals - Demonstrate understanding of confidence interval and purpose, compute confidence intervals, draw conclusions and interpret results
 - 1. Types of intervals - means, proportions, differences of means, differences of proportions

2. Margin of Error
 3. Standard error
 4. Confidence level
 5. Interval interpretation
- B. Hypothesis Testing - Demonstrate understanding of hypothesis test and purpose, compute hypothesis tests, draw conclusions and interpret results
1. Types of tests: z-test, t-test, paired t-test, tests for proportions, tests for differences
 2. Null & Alternative hypotheses
 3. Test statistic
 4. Significance level
 5. Type I and Type II errors
 6. Statistical significance
 7. Test interpretation
- VI. Normal Distribution - Understand and determine normality, compute normal probabilities
- A. Standard Score
 - B. Percentile
 - C. Empirical Rule
 - D. Relation to sampling variability
- VII. Relationships - Indicate knowledge and understanding in determining types of relationships for bivariate data and their implications, perform simple linear regression using technology, interpret results
- A. Scatterplots
 - B. Correlation
 - C. Regression
 - D. Least squares equation
 - E. Coefficient interpretation
- VIII. Probability and probability distributions - Knowledge and understanding of basic probability rules, perform probability calculations, determine various probability distributions and calculate probabilities
- A. Relative frequency
 - B. Expected Value
 - C. Probability rules
 1. Multiplication rule
 2. Addition rule
 3. Conditional probability

4. Independence
- D. Probability distributions
 1. Discrete distributions
 - a. Binomial distribution
 - b. Geometric distribution
 - c. Poisson distribution (optional)
 2. Continuous distributions
 - a. Normal distribution
 - b. Gamma distribution (optional)
 - c. Beta distribution (optional)