STA 2122: Statistics for Behavioral and Social Sciences I

Syllabus/Course Description

Effective: August 2017

Prerequisite: High School Algebra **Terms Offered:** Fall, Spring and Summer

Text: Statistics, 13th Edition customized for FIU, by James T. McClave and Terry Sincich

Lab: Students are required to attend the Mastery Lab (GL 266) two hours each week of the term. Lab attendance will be worth 10% of the final course grade.

Learning Objectives:

1. **Statistics, Data, and Statistical Thinking?** (Chapter 1)

   Introduce Statistics as a branch of science. Explain the goal of Statistics. Statistical methods: descriptive and inferential. Discuss basic concepts: data, population, sample. census, surveys. Discuss types of data and data collection methods. Simple random sampling. Role of statistics in the scientific method.

   LO 1: Describe the Role of Statistics in the Scientific Method
   LO 2: Identify a Statistical Population
   LO 3: Describe a Statistical Sample
   LO 4: Paraphrase the Reasons for Taking a Sample
   LO 5: Define Population Parameters
   LO 6: Define Sample Statistics
   LO 7: Contrast Descriptive Statistics and Inferential Statistics
   LO 8: Classify Data as Categorical Data or Numerical Data
   LO 9: Contrast Discrete Data and Continuous Data
   LO 10:Define the Key Component of a Simple Random Sample

2. **Methods for Describing Sets of Data** (Chapter 2: Sections 2.1-2.5 and 2.7)

   Discuss frequency tables and graphs for qualitative and quantitative data. Measures of central tendency and variability for quantitative data. Measures of relative standing.

   LO 11: Summarize Raw Data Using Relative Frequency Tables and Graphs for Qualitative and Quantitative Data
   LO 12: Demonstrate an Ability to Read Summation Notation
   LO 13: Identify the Role of Measures of the Center in Descriptive Statistics
   LO 14: Determine When the Mean Will Not Represent What is Typical in the Data Set
   LO 15: Categorize a Distribution as Either Left Skewed, Right Skewed, or Symmetric
   LO 16: Identify the Role of Measures of Dispersion in Descriptive Statistics
   LO 17: Calculate the Standard Deviation for a Set of Data
   LO 18: Contrast the Units for Variance and S.D. for a Set of Measurements
   LO 19: Calculate and Interpret Z-scores (as a Measure of Unusualness)
   LO 20: Use Z Scores to Compare the Relative Standing of Two Measurements

   Optional Learning Objectives (Recommended, Not Required)
   -- Using the Empirical Rule, Construct Intervals That Capture Approximately 68%, 95%, and 99.7% of Measurements Belonging to a Given Bell-Shaped Distribution.

-- Use Chebyshev's Theorem to Determine the Minimum Percentage of Measurements Within a Given Interval.

3. **Probability** (Chapter 3: Sections 3.1-3.6)

Discuss the basic concepts in probability: random experiment, sample space, sample points, events. Venn diagrams. Define the probability of an event. Compound events: intersection, union and complement of events. Probability rules. Mutually exclusive events. Conditional probabilities and independent events.

LO 21: Know the Probability for an Event Must Be a Value Between Zero and One
LO 22: Use the Empirical Approach to Calculate the Probability of an Event
LO 23: Know When to Assume Equally Likely Outcomes When Calculating Probability
LO 24: Explain the Law of Large Numbers
LO 25: Interpret a Given Probability Value
LO 26: Contrast $P(A \cup B)$ and $P(A \cap B)$
LO 27: Contrast the Meaning of Mutually Exclusive Events and Independent Events
LO 28: Interpret a Conditional Probability
LO 29: Given the Probability of Event A, Calculate the Probability of Its Complement

Optional Learning Objectives (Recommended, Not Required)
-- For Two Events, A and B, Calculate $P(A \cup B)$
-- For Two Events, A and B, Calculate $P(A \mid B)$
-- For Two Independent Events, A and B, Calculate $P(A \cap B)$
-- For Two Dependent Events, A and B, Calculate $P(A \cap B)$
-- Compute the Number of Outcomes for an Experiment Using an Appropriate Counting Technique
-- Understand the Importance of Base Rates When Estimating a Conditional Probability

4. **Discrete Random Variables** (Chapter 4: Sections 4.1-4.4)

Define random variable. Introduce the types of random variables. Introduce probability distributions for discrete random variables. Compute the mean and variance of a discrete random variable. Give the characteristics of a binomial random variable, and use the binomial probability formula and table to find the probability for possible outcomes of a binomial experiment.

LO 30: Describe the Characteristics of a Discrete Probability Distribution
LO 31: Find the Probability of an Event Using a Probability Distribution Expressed as a Table or Graph
LO 32: Calculate the Mean (Expected Value) of a Discrete Random Variable
LO 33: Interpret the Expected Value of a Discrete Random Variable
LO 34: Know the Defining Characteristics of a Binomial Experiment
LO 35: Use the Binomial Formula to Calculate the Probability of an Outcome of a Binomial Experiment
LO 36: Calculate the Mean of a Discrete Random Variable that has a Binomial Distribution
LO 37: Calculate the Standard Deviation of a Discrete Random Variable that has a Binomial Distribution

Optional Learning Objectives (Recommended, Not Required)
-- Calculate the Standard Deviation of a Discrete Random Variable
-- Interpret the Standard Deviation of a Discrete Random Variable
-- Use the Binomial Table to Calculate Probability for Outcomes of a Binomial Experiment

5. **Continuous Random Variables** (Chapter 5: Sections 5.1 and 5.3)

Introduce probability distributions for continuous random variables with emphasis on the normal distribution. Use the standard normal table to find probabilities and z-scores.

LO 38: Contrast Probability for Continuous Random Variables with that of Discrete Random Variables
LO 39: Use a Z table to Find Areas Under the Standard Normal Curve between the Mean and a Value
LO 40: Calculate Areas Under the Standard Normal Curve Inside an Interval Surrounding the Mean
LO 41: Calculate Areas Under the Standard Normal Curve between a Positive Z Value and Infinity
LO 42: Calculate Areas Under the Standard Normal Curve between Two Values on the Same Side of the Mean
LO 43: Calculate Areas Under the Standard Normal Curve between a Negative Z Value and Infinity
LO 44: Calculate the Probability for Non-Standard Normal Random Variables
LO 45: Calculate the Value Corresponding to an Upper Percentile of the Normal Distribution
LO 46: Calculate the Value Corresponding to a Lower Percentile of the Normal Distribution

6. **Sampling Distributions** (Chapter 6: Sections 6.1 and 6.3)

Discuss the inferential statistics scheme. Define parameters, statistics and sampling distributions. Sampling distribution of the sample mean: Central Limit Theorem (discussion only, not exercises)

LO 47: Define Sampling Distributions
LO 48: Describe the Standard Error of an Estimator
LO 49: Discuss the Desired Traits of a Point Estimator
LO 50: Know the Mean of the Distribution of Sample Means
LO 51: Know the Standard Deviation (Error) of the Distribution of Sample Means
LO 52: Compare the Variation of Sample Means to the Variation of the Random Variable
LO 53: Discuss the Central Limit Theorem
LO 54: Determine if a Sample Size is Large Enough to Employ the Central Limit Theorem

Optional Learning Objectives (Recommended, Not Required)
-- Apply the Central Limit Theorem to Calculating Probabilities for the Sample Mean
-- Discuss the Sampling Distribution of the Sample Proportion

7. **Inferences Based on A Single Sample: Estimation** (Chapter 7:Sections 7.1-7.4)

Define confidence interval. Introduce the T-probability distribution. Compute confidence intervals for a population mean μ based on both large and small samples, and confidence intervals for a population proportion p for large samples.

LO 55: Interpret a Confidence Interval
LO 56: Discuss Factors Affecting the Margin of Error or Width of Confidence Intervals
LO 57: Find the Critical Value for a Confidence Interval for the Mean Using a Large Sample
LO 58: Calculate the Margin of Error for a Confidence Interval for the Mean Using a Large Sample
LO 59: Construct a Confidence Interval for a Population Mean Using a Large Sample
LO 60: Determine the Necessary Sample Size to Estimate the Mean
LO 61: Know the Differences between the t Distribution and the Z Distribution

LO 62: Find the Critical Value for a Confidence Interval for the Mean Using a Small Sample
LO 63: Calculate the Margin of Error for a Confidence Interval for the Mean Using a Small Sample
LO 64: Construct a Confidence Interval for the Population Mean Using a Small Sample
LO 65: Calculate the Margin of Error for a Confidence Interval for a Proportion
LO 66: Construct a Confidence Interval for a Population Proportion Using a Large Sample

Optional Learning Objectives (Recommended, Not Required)
--Determine the Necessary Sample Size to Estimate the Mean

8. **Inferences Based on A Single Sample: Tests of Hypotheses** (Chapter 8: Sections 8.1-8.3 and 8.5-8.6)

Discuss the elements of a test of hypothesis. Rejection region as a decision rule. Define Type I and Type II errors. Significance level of the test. Introduce p-value as the observed probability of type I error. Decision rule based on p-values (No computations of p-values is required). Perform tests of hypotheses about a single population mean based on both large and small samples, and about a single population proportion based on large samples.

LO 67: Determine the Null and Alternative Hypothesis
LO 68: Know that the Alternative Hypothesis Requires Supporting Evidence
LO 69: Discuss the Four Possible Outcomes for a Hypothesis Test
LO 70: Describe a Type I Error
LO 71: Describe a Type II Error
LO 72: Classify an Error as Either Type I or Type II
LO 73: Discuss the Probability of Committing a Type I Error for a One-Tailed Test
LO 74: Discuss the Probability of Committing a Type I Error for a Two-Tailed Test
LO 75: List the Ways to Reduce the Likelihood of a Type I Error
LO 76: Determine the Consequences of Increasing or Decreasing the Significance Level
LO 77: Explain the Logic of the Test Statistic
LO 78: Calculate the Test Statistic for a Hypothesis Test about a Mean
LO 79: Determine the Rejection Region for a One-tailed Hypothesis Test about a Mean Based on a Large Sample
LO 80: Determine the Rejection Region for a Two-tailed Hypothesis Test about a Mean Based on a Large Sample
LO 81: Express the Final Conclusion of the Hypothesis Test Based on the Initial Conclusion
LO 82: Perform a Test of Hypotheses about a Population Mean Based on a Large Sample
LO 83: Determine the Rejection Region for a Hypothesis Test about a Mean Based on a Small Sample
LO 84: Perform a Test of Hypotheses about a Population Mean Based on a Small Sample
LO 85: Know the Decision Rule when Using the P-value Approach to Hypothesis Testing
LO 86: Use a Given P-value and Significance Level to Form an Initial Conclusion
LO 87: Calculate the Test Statistic for a Hypothesis Test about a Proportion
LO 88: Perform a Test of Hypotheses about a Population Proportion Based on a Large Sample

Optional Learning Objectives (Recommended, Not Required)
-- Calculate the P-value for a Two-Tailed Hypothesis Test
-- Calculate the P-value for a One-Tailed Hypothesis Test
-- Use a Confidence Interval to Test a Claim