Introduction to Statistics

Description: This is an introductory course in statistics. Students are introduced to the fundamental concepts involved in using sample data to make inferences about populations. Included are the study of measures of central tendency and dispersion, finite probability, probability distributions, statistical inferences from large and small samples, linear regression, and correlation.

General Education Learning Outcome: The primary General Education Learning Outcome (GELO) for this course is Quantitative Reasoning, which is to understand and apply mathematical concepts and reasoning, and analyze and interpret various types of data. The GELO will be assessed through targeted questions on either the comprehensive final or an outside assignment.

Prerequisite: MAT1033 or MAT1034 with a grade of “C” or better, OR the equivalent.

Rationale: In an increasingly complex world, statistical thinking, understanding, and skill are more important than ever. This course provides students with skills for proficiency in statistics, and the opportunity to learn to communicate and reason statistically.

Impact Assessment: Introduction to Statistics provides students with skills for proficiency in descriptive and inferential statistics. The course also applies toward the General Education mathematics requirement area A for an Associate of Arts degree. STA2023 is a prerequisite for Statistics 2, business statistics, and several other junior and senior level courses; and it is required for many degrees in business, the sciences, and the social sciences.

Broad Course Objectives: This course supports the following goals of the Math Department:

- Engage students in sound mathematical thinking and reasoning. This should include students finding patterns, generalizing, and asking/answering relevant questions.
- Provide a setting that prepares students to read and learn mathematics on their own.
- Explore multiple representations of topics including graphical, symbolic, numerical, oral, and written. Encourage students to make connections among the various representations to gain a richer, more flexible understanding of each concept.
- Analyze the structure of real-world problems and plan solution strategies. Solve the problems using appropriate tools.
- Develop a mathematical vocabulary by expressing mathematical ideas orally and in writing.
- Enhance and reinforce the student’s understanding of concepts through the use of technology when appropriate.
STA2023 Course Outline

As a result of successfully completing STA2023, students should be able to demonstrate the following:

- Analyze/interpret quantitative data verbally, graphically, symbolically and numerically.
- Communicate quantitative data verbally, graphically, symbolically and numerically.
- Appropriately integrate technology into mathematical processes.
- Use mathematical concepts in problem-solving through integration of new material and modeling.

Topical Outline with Specific Course Objectives:

I. Descriptive Statistics
   A. Calculate and interpret the various descriptive measures for centrality and dispersion.
   B. Determine potential outliers of data sets and understand how they affect the various numerical measures.
   C. Analyze and/or compare different sets of data using graphs, charts, tables, and numerical measures, and write about them in clear and precise sentences using statistical vocabulary.
   D. Demonstrate an understanding of the different types of distributions.
   E. Organize and display data by means of various tables, charts, and graphs.
   F. Define and use the basic terminology of statistics.

II. Simple Linear Regression and Correlation
   A. Find and interpret the sample correlation coefficient (r) to determine the strength and direction of the linear relationship between predictor and response variables.
   B. Use scatter plots to determine if outliers are present and if data can be represented by a simple linear regression model.
   C. Find the simple linear regression model and be able to interpret the slope and y-intercept.
   D. Use r-squared to determine if a simple linear regression model is a strong predictor.
   E. Predict values of “y” using the simple linear regression model

III. Normal Probability Distribution
   A. Understand the Normal Probability Distribution and be able to determine appropriate areas under a normal curve.
   B. Use the Empirical Rule (68-95-99.7 rule) to find probabilities on mound shaped distributions.
   C. Using a histogram or normal probability plot, determine if a sample comes from a normally distributed population.

IV. Fundamentals of Probability
   A. Understand and apply basic rules of probability.
   B. Understand and apply the Binomial Probability Distribution.
C. Identify the random variable involved in a statistical problem and distinguish between: categorical vs quantitative, discrete vs continuous, and binomial vs normal.

V. **Inferential Statistics**
   
   A. Demonstrate at least a rudimentary understanding of basic sample and experimental design (i.e. randomness, bias, etc.).
   
   B. Understand and apply the Central Limit Theorem.
   
   C. Estimate means and proportions using confidence intervals for one or two populations.
   
   D. Be able to perform hypothesis tests on means and proportions for one or two populations.
   
   E. Determine and interpret p-values.

VI. **Demonstrate competency in the use of technology, including graphing calculator and/or statistical computer software as it applies to topics I – V.**

**Evaluation:** Each instructor will determine the specific criteria for the final course grade. These criteria will be delineated in the first day handout provided to each student. Each instructor will give a comprehensive final exam during the assigned final exam period.

**Commonality:** All instructors will use the same textbook and cover all topics in the topical outline. A computer lab with mathematical software is provided to facilitate collaboration and the use of technology. A graphing calculator will be required for this course. Either the TI-83 or the TI-84 lines of calculators are strongly recommended. Students will use technology to do a project or several small assignments.