Statistics 1: An Introduction to Statistical Reasoning – Learning Outcomes and Scope of Coverage

Course description for College Catalogs

Recognizing that data and variability impact our daily decisions, *Statistics I: An Introduction to Statistical Reasoning* focuses on developing statistical literacy through an investigative process of problem-solving and decision-making. Students participate in the statistical process by formulating questions, analyzing data, and interpreting results, learning to become critical consumers of statistical information.The course introduces students to descriptive and inferential statistics.Topics include statistical distributions, linear regression and correlation, surveys and experiments, sampling distributions, probability, confidence intervals and hypothesis testing. A variety of statistical tools and software are used to explore concepts and deepen students' conceptual understanding of the topics.

Course Learning Outcomes and Scope of Coverage

Learning Outcome By the end of the course, students will be able to:	**Scope of Coverage** Key concepts, skills, and knowledge students are expected to master
Technology- Select and use available technology to perform routine computations and to explore, simulate, analyze, and illustrate abstract statistical processes and solve statistical problems.	• Identify, select, and apply appropriate technologies (e.g., open-source online statistical tools, programming languages, industry-standard software, graphical calculators, and platforms) to summarize, analyze, and interpret data for solving statistical problems.
Statistical Process- Formulate statistical questions that anticipate variability, investigate data collection methods that acknowledge variability, use distributions to analyze data, allow for variability when interpreting results, and quantify variability.	• Use the four steps in the statistical process: Formulate questions, collect data, analyze data, and interpret results
Statistical Process- Interpret and critique statistical results in context from a variety of publications, distinguish between observational and experimental studies, identify and determine sources of bias and confounding, and	• Distinguish between well-designed experiments and observational studies, identify instances of confounding, and use appropriate terminology (e.g.,

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determine when results can be generalized to a population and when the results of a study can be used to establish causal relationships.	placebo effect, blind, double-blind, control group, treatment group, replication, explanatory variables) accurately in context. • Identify various examples of selection bias (e.g., size bias, voluntary response bias, convenience sampling, judgment sampling) and response bias (e.g., non-response bias, questionnaire bias, incorrect response bias) • Recognize various methods of data collection and sampling techniques • Distinguish between the following: population and a sample, a parameter and a statistic, qualitative and quantitative data • Classify data as nominal, ordinal, interval, and ratio • Identify, compare, and summarize sampling methods that protect against bias (e.g., simple random samples, stratified samples, cluster samples, two-stage sampling)
Descriptive Statistics- Identify, interpret, and construct a variety of numerical and statistical distributions from real data to convey meaning and answer statistical questions.	• Construct, label, and analyze tables, bar charts, pie charts, stem and leaf plots, dot plots, frequency distributions, and histograms, given a set of sample data • Accurately interpret graphically expressed data
Descriptive Statistics- Calculate and interpret measures of central tendency and dispersion, determine which measures of center and spread are appropriate by analyzing the shape of a distribution, and evaluate the influence of outliers on these measures.	• Compute sample statistics including mean, median, mode, range, variance and standard deviation • Compute and interpret quartiles, percentiles and z-scores • Calculate and interpret z-scores • Use the normal distribution to approximate the binomial distribution and solve a variety of unknown percentages and unknown value problems.
Probability- Apply basic probability theory and rules to describe variation, to solve problems involving the Normal Distribution and various probability distributions, and to determine statistical significance.	• Understand that probability is a tool for statistics and is a bridge between descriptive and inferential statistics • Find probabilities for normally distributed variables • Determine statistical significance

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Sampling Distributions and CLT- Generate sampling distributions for a variety of summary statistics to make inferences and illustrate, explain, and apply the Central Limit Theorem.	• Depict sampling distributions in terms of mean and standard error • Apply the Central Limit Theorem • Estimate statistical parameters • Use sampling distributions to make inferences • Use simulation to generate a variety of sampling distributions.
Confidence Intervals and Hypothesis Testing- Calculate and interpret confidence intervals for proportions and means and conduct and perform hypothesis testing to determine the statistical significance of results and to make appropriate statistical inferences.	• Estimate population parameters from sample statistics by calculating confidence intervals for one proportion, two proportions, one mean, and two means • Determine sample sizes for various margins of error • Conduct and interpret hypotheses tests for one proportion and one mean. • Recognize the difference between Type I and Type II errors, determine if it is possible to make a Type I or Type II error, and how to minimize those errors
Regression and Correlation- Create, interpret, and analyze scatter plots and produce a linear regression model to identify the strength of association of a linear trend and make predictions, if appropriate, and identify situations where correlation does not imply causation.	• Calculate and interpret correlation coefficient • Compute equation of the "Line of Best Fit" (Regression Line) and use it to predict y-values • Find and interpret coefficient of determination • Produce a linear regression model to solve an application problem