

Marshall University
College of Science
Mathematics Department

STA 225: Introductory Statistics (CT)

Course catalog description

A critical thinking course in applied statistical reasoning covering basic probability, descriptive statistics, and fundamental statistical inference procedures. Parameter estimation and hypothesis testing for variety of situations with wide applications.

Credit hours

3 hours

Prerequisites

ACT Math 21 or equivalent, or a grade of C in MTH 121 or higher

Critical thinking (CT) designator

This course carries a CT designator, and students who complete the course receive 3 hours of CT credit towards their general education requirements.

List of topics

1. Introduction

Descriptive and Inferential Statistics
Data Collection Methods

2. Descriptive Statistics

Frequency Distributions

- Regular Frequency Distributions
- Cumulative Frequency Distributions
- Relative Frequency Distributions

- Grouped Frequency Distributions
- Histograms and Other Graphic Representation

Measures of Central Tendency

- Mean
- Median
- Mode

Measures of Variability

- Range
- Variance
- Standard Deviation

Measures of Position

- Percentiles
- z-scores

3. Probability

Counting Techniques

- The Multiplication Rule
- Factorials and Permutations
- Partitions
- Combinations

Probability Rules

- Definitions of Probability
- Probability of a Union
- Probability of an Intersection
- Probability of a Complement

Probability Distributions

- Expectation and Variance
- The Binomial Distribution
- The Normal Distribution

4. Inferential Statistics

Inferences about the Mean of a Single Population

- The Central Limit Theorem and the Distribution of the Sample Mean
- Point Estimation and Interval Estimation
- Hypothesis Testing: Known Variance; Large-Sample, Unknown Variance; Small-Sample, Unknown Variance; Student's t-distribution

Inferences about the Difference between Two Population Means

- Sampling Distribution of the Difference of Two Sample Means
- Point Estimation and Interval Estimation
- Hypothesis Testing

Inferences about a Single Population Proportion

- Sampling Distribution of a Sample Proportion
- Point Estimation and Interval Estimation
- Hypothesis Testing

Inferences about the Difference between Two Population Proportions

- Sampling Distribution of the Difference of Two Sample Proportions
- Point Estimation and Interval Estimation
- Hypothesis Testing

Linear Correlation and Regression

- Pearson Correlation Coefficient
- Linear Regression

One-Way Analysis of Variance

Introduction to Nonparametric Techniques

- Goodness of Fit
- Test for Independence

Misuses of Statistics

Course student learning outcomes

1. **Integrative Thinking:** Students will make connections and transfer skills and learning among varied disciplines, domains of thinking, experiences, and situations.
2. **Communication Fluency:** Students will develop cohesive oral, written, and visual communications tailored to specific audiences.
3. **Inquiry Based Thinking:** Students will formulate focused questions and hypotheses, evaluate existing knowledge, collect and analyze data, and draw justifiable conclusions.
4. **Metacognitive Thinking:** Students will evaluate the effectiveness of a project plan or strategy to determine the degree of their improvement in knowledge and skills.
5. **Quantitative Thinking:** Students will analyze real-world problems quantitatively, formulate plausible estimates, assess the validity of visual representations of quantitative information, and differentiate valid from questionable statistical conclusions.

Course student learning outcomes

1. Students will select and produce appropriate graphical, tabular, and numerical summaries of the distributions of variables in a data set. Summarize such information into verbal descriptions.
2. Students will summarize relationships in bivariate data using graphical, tabular, and numerical methods including scatter plots, correlation coefficients, and least squares regression lines.
3. Students will construct a model for a random phenomenon using outcomes, events, and the assignment of probabilities. Use the addition rule for disjoint events and the multiplication rule for independent events.
4. Students will be able to recognize the difference between discrete and continuous random variables and probability distribution.

Especially use the normal distribution to interpret z-scores and compute probabilities.

5. Students will estimate a population mean, a population proportion or difference between means and difference between proportions using point estimates and confidence intervals and interpret the confidence level and margin of error. Understand the dependence of margin of error on sample size and confidence level.
6. Given research questions involving a single population or two populations, student will be able to formulate null and alternative hypotheses. Describe the logic and framework of the inference of hypothesis testing. Make decisions using classical and p-value approaches and draw appropriate conclusions. Interpret statistical and practical significance in this setting.

Suggested textbooks

- Bluman, *Elementary Statistics: A step by step approach (a brief version)*, seventh edition

Last updated

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