

Marshall University

College of Science

Mathematics Department

## **MTH 225: Introductory Statistics**

### **Course catalog description**

Basic probability, descriptive statistics, fundamental statistical inference procedures involving estimation and hypothesis testing for a variety of situations with wide applications.

### **Credit hours**

3 hours

### **Prerequisites**

ACT Math 21 or SAT Math 500, or a grade of C in MTH 121 or higher

### **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

## Learner outcomes

- 1. Exhibit an understanding of basic statistical concepts.**
  1. Differentiate between descriptive and inferential statistics.
  2. Describe, and differentiate among, various method of data collection.
- 2. Summarize and describe sets of data.**
  1. Produce and interpret frequency distributions and histograms.
  2. Compute measures of central tendency and variability, and use them to describe a set of data.
  3. Compute measures of position and use them to determine relative standing.
- 3. Exhibit an understanding of probability and its rules.**
  1. Use the combinatorial formulas to determine the number of outcomes in an event.
  2. Use the definition of probability and the combinatorial formulas to compute the probability of a simple event.
  3. Use the laws of probability to determine the probability of a compound event (union, intersection, or complement).
  4. Compute and interpret expectation and variance for a given discrete probability distribution.
  5. Use the binomial probability function to compute binomial probabilities.
  6. Use binomial tables to find binomial probabilities.
  7. Use the normal table to find normal probabilities (standard and non-standard).
  8. Use the normal distribution to approximate binomial probabilities.
- 4. Explain and use techniques for drawing inferences about a population based on information contained in a sample.**
  1. Use the Central Limit Theorem to find probabilities involving a sample mean.
  2. Explain how an interval estimate can be obtained from a point estimate whose sampling distribution is normal.
  3. Compute and interpret confidence intervals for a population mean, the difference of two population means, a population proportion, and the difference of two population proportions.

4. Explain how a statistical hypothesis can be tested using a point estimate whose sampling distribution is normal.
5. Define and carry out tests of hypotheses involving a population mean, the difference of two population means, a population proportion, and the difference of two population proportions.
6. Determine the strength of correlation of two variables.
7. Interpret the parameters of a linear regression model.
8. Fit a linear regression model and use it for prediction.
9. Use analysis of variance to test the equality of three or more population means.
10. Use the chi-square distribution to test the fit of a proposed model.
11. Use the chi-square distribution to test the independence of two random variables.

**5. Describe ways in which statistics can be used to mislead and deceive.**

**Suggested textbooks**

- Bluman, *Elementary Statistics: A Brief Edition*, 6th edition, ISBN 978-0-077-56766-8

**Last updated**

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