



South Central College

MATH 154 Elementary Statistics

Common Course Outline

Course Information

Description	This course introduces the essential mathematical elements of statistics, applying them to a broad range of areas including business, manufacturing, economics, and the physical, biological and social sciences. Topics include descriptive measures of data, measures of central tendency, variability, standard probability distributions, tests of hypotheses, confidence intervals, and estimation. To put the treatment on a strong foundation, concepts of probability are developed throughout, and shown to form the unifying theme behind modern statistics. (Prerequisites: Completion of MATH 0085 with a grade of C or higher (2.0), or an Accuplacer test score of 56 or above in Arithmetic AND a score of 76 or above in Elementary Algebra.)
Total Credits	4
Total Hours	64

Types of Instruction

Instruction Type	Credits/Hours
Lecture	4/64

Pre/Corequisites

Prerequisite Completion of MATH 0085 with a grade of C or higher (2.0), or an Accuplacer test score of 56 or above in Arithmetic AND a score of 76 or above in Elementary Algebra.

Institutional Core Competencies

Critical and Creative Thinking - Students will be able to demonstrate purposeful thinking with the goal of using a creative process for developing and building upon ideas and/or the goal of using a critical process for the analyzing and evaluating of ideas.

Course Competencies

1. Explain the four aspects of statistics

Learning Objectives

- Describe the collection of data and possible pitfalls
- Explain how data may be organized
- Describe in broad terms how statistical information may be summarized
- Explain how conclusions may be drawn from statistical information

2. Define key terms required when beginning to study statistics

Learning Objectives

Contrast descriptive statistics and inferential statistics
Contrast single-blind and double-blind experiments
Define an individual in the population and/or sample
Define variable and its values
Contrast qualitative and quantitative variables
Contrast discrete and continuous variables

3. Describe the characteristics of sampling approaches

Learning Objectives

Distinguish between an observation study and an experiment
Determine a simple random sample of a population
Contrast stratified, systematic, convenience and cluster samples
Describe sources of errors in sampling methods

4. Design an experiment

Learning Objectives

Explain the concept of a designed experiment
Describe the six steps in conducting an experiment

5. Organize qualitative data

Learning Objectives

Define frequency distribution
Define relative frequency
Illustrate qualitative data with a bar graph
Illustrate qualitative data with a pie chart

6. Organize quantitative data

Learning Objectives

Summarize discrete data in tables
Illustrate discrete data with a histogram
Summarize continuous data in tables
Explain class limits and class width
Illustrate continuous data with a histogram
Represent quantitative data with a stem-and -leaf plot

7. Classify distribution by shape

Learning Objectives

Identify uniform distributions
Identify bell-shaped distributions
Identify skewed distributions

8. Explain measures of central tendency

Learning Objectives

Contrast the population and sample arithmetic means
Define the median of a variable
Define the mode of a variable
Explain the effect of the mean, median and mode on the shape of a distribution

9. Explain measures of dispersion

Learning Objectives

Compute the range of a variable from raw data
Compute the variance of a variable from raw data
Compute the standard deviation of a variable from raw data

10. Explain measures of position

Learning Objectives

Determine and interpret z-scores
Determine and interpret percentiles

Determine and interpret quartiles
Check a set of data for outliers

11. Explain correlation

Learning Objectives

Draw a scatter diagram
Interpret a scatter diagram
Compute and interpret the linear correlation coefficient

12. Define a least-squares regression

Learning Objectives

Find the least-squares regression
Interpret the slope and y-intercept of the least-squares regression line
Predict the value of a response variable
Determine residuals based upon the least-squares regression line
Compute the sum of the squared residuals
Compute and interpret the coefficient of determination

13. Explain probabilities of simple events

Learning Objectives

Describe the fundamental properties of probabilities
Compute probabilities of simple events
Use simulation to approximate probabilities
Connect (b) and (c), above, to illustrate the Law of Large Numbers

14. Explain probabilities of compound events

Learning Objectives

Use the addition rule of mutually exclusive events
Illustrate the addition rule with a Venn diagram
Compute the probability of an event using complements

15. Explain probabilities of multi-stage events

Learning Objectives

Use the multiplication rule for independent events
Compute ranges of probabilities

16. Deduce counting techniques

Learning Objectives

Solve counting problems the multiplication principle
Solve counting problems using permutations
Solve counting problems using combinations
Compute probabilities using permutations and combinations

17. Describe a probability distribution

Learning Objectives

State the requirements for a discrete probability distribution
Construct a probability histogram
Compute and interpret the mean, variance and standard deviation of a discrete random variable
Compute and interpret the expected value of a discrete random variable

18. Define a binomial probability distribution

Learning Objectives

Determine whether a probability experiment is binomial or not
Compute probabilities of binomial experiments
Compute the mean and standard deviation of a binomial random variable

19. Deduce the properties of the normal distribution

Learning Objectives

Describe the uniform probability distribution
Graph normal density curve
Explain the role of area in the normal density function

20. Use area under a normal curve to compute numerical results

Learning Objectives

Find the area under the standard normal curve
Find Z-scores for the given areas
Interpret the area under the standard normal curve as a probability

21. Apply the normal distribution to probability problems

Learning Objectives

Interpret area under a normal curve
Find the value of a normal random variable
Draw normal probability plots to assess normality
Approximate binomial probabilities with the normal curve

22. Explain the concept of a sampling distribution

Learning Objectives

Explain the concept of a sampling distribution
Compute the mean and standard deviation of a sampling distribution of the mean
Compute probabilities of a sample mean obtained from a normal population
Compute probabilities of a sample mean using the Central Limit Theorem

23. Interpret the Central Limit Theorem as an application sampling distribution

Learning Objectives

Compute probabilities of a sample mean obtained from a normal population
Contrast with probabilities of a sample mean using the Central Limit Theorem

24. Define confidence interval estimates

Learning Objectives

Compute the point estimate of the population mean
Compute confidence intervals about the population mean when the population standard deviation is known
Explain margin of error when constructing confidence intervals
Determine the sample size required to estimate the population mean

25. Explain Student's t-distribution

Learning Objectives

Determine t-values
Construct confidence intervals about the population mean when the population standard deviation is unknown
Determine the method to compute an interval about the population mean

26. Explain confidence intervals about a population proportion

Learning Objectives

Compute a point estimate for the population proportion
Compute and interpret a confidence interval for the population proportion
Determine the sample size for estimating a population proportion

27. Define hypothesis testing

Learning Objectives

Determine null and alternative hypothesis from a claim
Contrast Type I and Type II errors
State conclusions to hypothesis tests

28. Test a hypothesis about mean with standard deviation known

Learning Objectives

Describe the logic of hypothesis testing
Test a hypothesis using the classical method

Test a hypothesis using the P-value approach
Test a hypothesis using confidence intervals

29. Test a hypothesis about mean with standard deviation unknown

Learning Objectives

Test a hypothesis using the classical method
Test a hypothesis using the P-value approach

30. Test a hypothesis about a population proportion

Learning Objectives

Test a hypothesis using the classical method
Test a hypothesis using the P-value approach
Test a hypothesis about a population proportion on a small sample