

# Winona State University

## STAT 110: Fundamentals of Statistics

### A. COURSE DESCRIPTION

Credits: 3

Lecture Hours/Week: 0

Lab Hours/Week: 0

OJT Hours/Week: \*.\*

Prerequisites:

This course requires any of these 13 prerequisites

MATH 050 - Intermediate Algebra

MATH 100 - Mathematics for Sustainability

MATH 110 - Finite Mathematics

MATH 120 - Precalculus

MATH 140 - Applied Calculus

MATH 212 - Calculus I

STAT 100 - Numbers and Data in Society

MATH 142 - Matrix Algebra

A score of 1148 on test MN Comprehensive Assessment Math

A score of 18 on test ACT Math

A score of 50 on test Accuplacer Elementary Algebra

A score of 243 on test Accuplacer NG Quantitative Reasoning

A score of 20 on test ALEKS PPL Math Placement

Corequisites: None

MnTC Goals: Goal 04 - Mathematical/Logical Reasoning

Introductory statistics with emphasis on applications. Prerequisite: Qualifying score on the mathematics placement or STAT 100 - Numbers and Data in Society. Students in certain majors should take STAT 210 - Statistics instead of STAT 110. Meets GOAL 4. Offered every semester.

**B. COURSE EFFECTIVE DATES:** 08/20/1997 - Present

## C. OUTLINE OF MAJOR CONTENT AREAS

1. The Research Process
  - a. The research question/hypothesis and the predictor, response, and population of interest
  - b. The role of random samples; population vs. sample
  - c. Types of studies
    - i. experiments and the role of randomization
    - ii. observational studies and effects of confounding
    - iii. surveys and possible biases
2. Data Displays and Summary Statistics
  - a. Categorical variables
    - i. bar charts
    - ii. frequency distributions
  - b. For numeric variables
    - i. measure of central tendency: mean/average, median
    - ii. measures of variation: variance, standard deviation, interquartile range
    - iii. robustness
    - iv. histograms and boxplots
  - c. Contingency tables
    - i. row/column percentages
    - ii. relative risk, difference between proportions, and odds ratios
    - iii. relationships in  $r \times c$  tables
  - d. Scatterplots
    - i. measures of correlation
    - ii. simple linear regression
3. Introduction to Sampling Distributions
  - a. Statistics vs. parameters
  - b. Sampling errors
  - c. The importance of random samples
4. IV. Confidence Interval Estimation
  - a. One-sample confidence intervals
    - i. inference about a single proportion
    - ii. inference about a single mean
  - b. Two-sample confidence intervals
    - i. inference about a difference between two proportions
    - ii. inference about relative risks
    - iii. inference about a difference between means
  - c. Paired-sample confidence interval, involving inference about a mean difference
5. Hypothesis Testing
  - a. Logic of hypothesis tests
    - i. formulating hypotheses
    - ii. p-values, type I & type II errors
  - b. Interpretation of results
    - i. association vs. causation
    - ii. description of a sample vs. inference about a population
    - iii. statistical vs. practical significance
6. Comparative Analysis
  - a. Independent samples
    - i. difference between proportions
    - ii. difference between means
    - iii. Mann-Whitney-Wilcoxon Test
  - b. Paired-sample tests
    - i. paired-sample t-test
    - ii. Wilcoxon signed-rank test
  - c. Tests for contingency tables
    - i. Fisher's Exact Test for  $2 \times 2$  tables
    - ii. Chi-square test

#### **D. LEARNING OUTCOMES (General)**

1. Use logical reasoning by studying mathematical patterns and relationships. A successful student will be able to investigate the different ways in which to determine patterns for variables and evaluate the relationship between them.
2. Use mathematical models to describe real-world phenomena and to solve real-world problems, as well as understand the limitations of models in making predictions and drawing conclusions. A successful student will be able to design and carry out a real-world experiment or observational study and properly state the findings and conclusions.
3. Organize data, communicate the essential features of the data, and interpret the data in a meaningful way. A successful student will be able to organize data, communicate essential features of the data both numerically and graphically and provide interpretations and conclusions.
4. Do a critical analysis of scientific and other research. A successful student will be able to answer a desired research question through hypothesis testing by providing implications, interpretations and conclusions.
5. Extract correct information from tables and common graphical displays. A successful student will be able to draw conclusions and express relationships (both orally and written) illustrated in graphical displays such as line graphs, scatter plots, histograms and frequency tables.
6. Use appropriate technology to describe and solve quantitative problems. A successful student will be able to use the statistical software package JMP to perform most analyses in this course. The students will also be able to interpret the results from the given output.

#### **E. Minnesota Transfer Curriculum Goal Area(s) and Competencies**

Goal 04 - Mathematical/Logical Reasoning

1. Illustrate historical and contemporary applications of mathematical/logical systems.
2. Clearly express mathematical/logical ideas in writing.
3. Explain what constitutes a valid mathematical/logical argument(proof).
4. Apply higher-order problem-solving and/or modeling strategies.

#### **F. LEARNER OUTCOMES ASSESSMENT**

As noted on course syllabus

#### **G. SPECIAL INFORMATION**

None noted