

**J. Sargeant Reynolds Community College
Course Content Summary**

Course Prefix and Number: MTH 246

Credits: 3

Course Title: Statistics II

Course Description: Continues the study of estimation and hypothesis testing with emphasis on advanced regression topics, experimental design, analysis of variance, chi-square tests, and non-parametric methods. Focuses on multivariate and nonparametric techniques useful to business, science, and social science majors. Replaces MTH 242. Prerequisite: Completion of MTH 245 or equivalent with a grade of C or better. Lecture 3 hours per week.

General Course Purpose: This course may fill the requirement for students whose four-year transfer institutions require an advanced statistics or research methods course as part of the requirements for their chosen major. Students should consult with four-year institution regarding the transferability of this course into a specific major, as some college majors will require this course to be taken at the four-year institutions.

Course Prerequisites and Co-requisites:

Prerequisite: Completion of MTH 245 or equivalent with a grade of C or better

Student Learning Outcomes:

Upon completing the course, the student will be able to perform more statistics that focus on multivariate and nonparametric techniques useful to business, science, and social science majors.

1. Review of Hypothesis Testing
 - Conduct hypothesis tests for population means and proportions;
 - Conduct a hypothesis test for the equality of two population means where:
 - The samples are independent and the population variances are assumed unequal;
 - The data consists of matched pairs;
 - Conduct a hypothesis test for the presence of correlation;
2. Experimental Design
 - Define and apply the basic principles of design, including randomization, replication, and treatment/control groups;
 - Explain single and double blinding;
 - Describe the placebo and experimenter effects and describe how they can be countered using blinding;
 - Design experiments using the following methods:
 - Completely randomized;
 - Randomized block;
 - Matched pairs;
 - Explain the concept of confounding;

3. Correlation and Regression
 - Construct and interpret the residual plot related to a simple least-squares regression model;
 - Conduct hypothesis tests related to the coefficients of a simple least-squares regression model;
 - Construct and apply a logistic regression model;
 - Calculate the coefficient of determination, the adjusted coefficient of determination, and overall P-value for a multiple regression model and use them to construct a best-fit multiple regression equation;
4. Categorical Data Analysis
 - Conduct chi-squared tests for:
 - Goodness of fit;
 - Independence between rows and columns of a two-way contingency table;
 - Homogeneity of population proportions;
5. Analysis of Variance (ANOVA)
 - Conduct one-way ANOVA to test the equality of two or more population means for both equal and unequal sample sizes and recognize its relationship to the pooled two sample t-test;
 - Conduct a multiple comparison test, such as Tukey's HSD, to determine which of the three or more population means differs from the others;
 - Conduct two-way ANOVA on sample data categorized with two fixed factors;
6. Nonparametric Methods
 - Determine the rank of each element of a sorted data set;
 - Identify the relationship between a nonparametric test and its corresponding parametric technique;
 - Conduct a Wilcoxon signed-ranks test for a single sample;
 - Conduct a Wilcoxon signed-ranks test for matched pairs;
7. Technology Application
 - Construct statistical tables, charts, and graphs using appropriate technology;
 - Perform statistical calculations using an appropriate statistical software package;
 - Complete statistical project. (See notes under pedagogical recommendations.)

Major Topics to Be Included:

1. Review of Hypothesis Testing
2. Experimental Design
3. Correlation and Regression
4. Categorical Data Analysis
5. Analysis of Variance (ANOVA)
6. Nonparametric Methods
7. Technology Application.

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