COURSE OUTLINE

Course Number	Course Title	Credits
MAT 200	**Statistics for Social and Health Sciences**	**3**
Hours: Lecture/Lab/Other	**Co- or Pre-requisite**	**Implementation Semester & Year**
3/0/0	**MAT 038 or MAT 044 or Multiple Measures Placement**	**Spring 2022**

Catalog description:
An applied statistics course for the social sciences, nursing, etc. Topics include sampling procedures, descriptive statistics, regression and correlation, discrete, binomial and normal probability distributions, confidence intervals and hypothesis tests for one mean, two means, one proportion, and two proportions, one-way and two-way ANOVAs, goodness-of-fit tests and tests of independence. Uses MINITAB statistical software.

General Education Category:
Goal 2: Mathematics

Course coordinator:
Charlene Sharkey, 609-570-3892, sharkeyc@mccc.edu

Required texts & Other materials:

No Book Required – Materials will be supplied through Blackboard.
Minitab – Free trial available or on some MCCC computers
Calculator - TI 30 Multi-view, TI 34 Multi-view, TI 36 Pro, or other TI statistical/graphing calculator (Please ask prior to purchasing a new one if you do not have one on the list.)

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. Distinguish the difference between a population and a sample, a qualitative variable and a quantitative variable, and a discrete variable and a continuous variable. [Supports ILG #2, 11]
2. Explain what is meant by a representative sample, determine the sampling procedure in which a sample was taken and take a random sample using different sampling procedures. [Supports ILG #2, 11]
3. Construct frequency/relative frequency tables as well as various graphs, by hand and using a statistical software package, to describe both qualitative and quantitative variables, and discuss how graphs can be misleading. [Supports ILG #2, 4, 11]
4. Calculate measures of center, measures of spread, measures of position, determine outliers and determine the shape of a distribution, as well as create a graph, by hand and using a statistical software package, to show outliers and compare data sets. [Supports ILG #2, 4, 11]
5. Conduct a least squares regression analysis on a bivariate data set, by constructing a scatterplot, calculating and interpreting the correlation coefficient, slope, y- intercept, and coefficient of determination, calculating residuals as well as graphing a residual plot using a statistical software package and making predictions. [Supports ILG #2, 4, 11]
6. Calculate probabilities for discrete distributions, binomial distributions and normal distributions. [Supports ILG #2, 11]

7. Calculate margin of error, construct and interpret a confidence interval, calculate sample size, and perform a hypothesis test for one sample proportion and one sample mean as well as the differences between two means and two proportions by hand and using Minitab. [Supports ILG # 2, 4, 11]
8. Compare means of 3 or more populations using the methods of analysis of variance (ANOVA) and conduct a two-way ANOVA test using a statistical software package to determine the effect of two nominal predictor variables on a continuous outcome variable. [Supports ILG #2, 4, 11]
9. Perform a chi-square goodness-of-fit test to make inferences about the distribution of a variable and a chi-square independence test to decide whether an association exists between two variables of a population, given bivariate data for a sample of a population. [Supports ILG#2, 4, 11]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Units of study in detail – Unit Student Learning Outcomes:

Unit I Descriptive Statistics [Supports Course SLOs #1, 2, 3, 4]

Learning Objectives

The student will be able to:

- Explain what is meant by a representative sample.
- Describe simple random sampling, systematic random sampling, cluster sampling and stratified sampling.
- Determine the sampling procedure (simple random sampling, systematic random sampling, cluster sampling and stratified sampling) in which a sample was taken.
- Construct a data table identifying the cases, variables, and whether the variable is quantitative or categorical.
- Construct a pie chart and bar chart for categorical data.
- Interpret a contingency table using categorical data.
- Construct and interpret a histogram, stem-and-leaf display and a dot plot for one quantitative variable using a statistical software package.
- Identify the shape of a distribution.
- Discuss how graphs can be misleading.
- Calculate the median, mean, range, quartiles, interquartile range and standard deviation by hand of a quantitative variable.
- Calculate the 5-number summary using a computer software package and determine if the data set has any outliers by calculating the lower and upper fences.
- Construct a side-by-side stem-and-leaf by hand.
- Construct side-by-side boxplots using statistical software.
- Compare data sets using histograms, side-by-side stem-and-leaf and boxplots with respect to shape, outliers, center and spread for each group.

Unit II Regression and Correlations [Supports Course SLO #5]

Learning Objectives

The student will be able to:

- Graph a scatterplot between two quantitative variables using statistical software and determine if a linear relationship exists.
- State the assumptions and conditions of a linear correlation.
- Calculate the linear correlation coefficient by hand.
- Check the assumptions and conditions in order to construct a linear regression model.
- Determine the least squares regression equation for a set of data points by hand, interpret the slope of the regression line, and use the regression equation to make predictions.
- Calculate residuals and construct a residual plot of residuals versus predicted values to determine if a linear model is appropriate.

Unit III Binomial and Normal Distributions [Supports Course SLO #6]

Learning Objectives

The student will be able to:

- Determine the probability distribution of a discrete random variable.
- Find and interpret the mean and standard deviation of a discrete random variable.
- Obtain binomial probabilities and compute the mean and standard deviation of a binomial random variable.
- Identify the basic properties of and sketch a normal curve.
- Calculate and interpret z-scores.
- Determine areas under the standard normal curve and determine the z-scores corresponding to a specified area under the standard normal curve.
- Determine a percentage or probability for a normally distributed variable.
- Determine the observations corresponding to a specified percentage or probability for a normally distributed variable.
- Construct a normal Probability plot to show the appropriateness of the normal model.
- Approximate binomial probabilities by normal-curve areas, when appropriate.

Unit IV Confidence Intervals and Hypothesis Testing for One Sample Means and One Sample Proportions [Supports Course SLO #7]

Learning Objectives

The student will be able to:

- Define sampling error and explain the need for sampling distributions.
- Simulate the sampling distribution of sample mean given a population distribution.
- Find the mean and standard deviation of the variable, , given the mean and standard deviation of the population and the sample size.
- State and apply the central limit theorem.
- Determine the sampling distribution of the sample mean when the variable under consideration is normally distributed and when the sampling size is relatively large.
- Obtain a point estimate for a population mean.

- Find and interpret a confidence interval for a population mean when the population standard deviation is known.
- Compute and interpret the margin of error for the estimate of the population mean,
- Calculate the sample size for a given margin of error and specified confidence interval to estimate the population mean.
- State the basic properties of a t-curve.
- Find and interpret a confidence interval for a population mean when the population standard deviation is unknown.
- Find and interpret a confidence interval for a population proportion.
- Determine the sample size required for a given margin of error and specified confidence level for the estimate of a population proportion.
- Perform a hypothesis test for a population mean when the population standard deviation is known and when the standard deviation is unknown.
- Define and apply the concepts of Type I and Type II errors.
- Perform a hypothesis test for a population proportion.

Unit V Confidence Intervals and hypothesis testing for two population means and two population proportions [Supports Course SLOs # 7]

Learning Objectives

The student will be able to:

- Construct and interpret a confidence interval and perform a hypothesis test based on independent simple random samples to compare the means of two populations when the population standard deviations are unknown, but assumed to be equal; by hand and using a statistical software package.
- Construct and interpret a confidence interval and perform a hypothesis test based on independent simple random samples to compare the means of two populations when the population standard deviations are unknown, but are not assumed to be equal; both by hand and using a statistical software package.
- Construct and interpret a confidence interval and perform a hypothesis test based on a simple random paired sample to compare the means of two populations; by hand and using a statistical software package.
- Perform a hypothesis test based on a simple random paired sample to compare the means of two populations, when the paired-difference variable has a symmetric distribution; by hand and using a statistical software package.
- Decide which procedure should be used to perform a hypothesis test to compare the means of two populations.
- Construct and interpret a confidence interval and perform a hypothesis test based on large and independent samples to compare two population proportions by hand and using a statistical software package.

Unit VI One-way Analysis of Variance and Two-way Analysis of Variance [Supports Course SLO # 8]

Learning Objectives

The student will be able to…

- Explain the basic properties of an F-distribution.

- Calculate the F-statistic by hand and using a statistical software package.
- Explain the essential ideas behind a one-way analysis of variance.
- State and check the assumptions for a one-way ANOVA.
- Perform and interpret a one-way ANOVA test by hand and using a statistical software package.
- Perform and interpret a two-way ANOVA test using a statistical software package.

Unit VII Chi Square Tests [Supports Course SLO #9]

Learning Objectives

The student will be able to…

- Use the Chi-Square table.
- Explain the reasoning behind the chi-square goodness-of-fit test.
- Perform a chi-square goodness-of-fit test; by hand and using a statistical software package.
- Decide whether an association exists between two variables of a population, given bivariate data for the entire population, by hand and using a statistical software package.
- Explain the reasoning behind the chi-square independence test.
- Perform a chi-square independence test to decide whether an association exists between two variables of a population, given bivariate data for a sample of the population; by hand and using a statistical software package.

Evaluation of student learning:

All course student learning outcomes will be assessed by the following activities. Test and quiz questions will be selected to evenly assess all expected outcomes.

Grades may be assigned as detailed below:

Tests (3) – 60%, Projects (2 or 3) – 20%, Quizzes – 20%