



COURSE OUTLINE

Course Number
MAT 200

Course Title
Statistics for Social and Health Sciences I

Credits
3

Hours:
lecture/Lab/Other
3 Lecture

Co- or Pre-requisite
Pre-requisite: MAT 135 with a minimum C grade or
appropriate college level placement test or permission
of department

Implementation
sem/year
Fall 2009

Catalog description (2013-2014 Catalog):

An applied statistics course for the social sciences, nursing, etc. Topics include data production and access, one variable data analysis, sample regression and correlation, binomial and normal distributions, confidence intervals, and hypothesis tests for a sample mean. Uses MINITAB statistical software.

Is course New, Revised, or Modified?

Revised Fall 2012

Required texts/other materials:

Book: Statistics: Informed Decisions Using Data, Third Edition, Michael Sullivan III, Prentice Hall

Calculator: Scientific or graphing calculator required.

Revision date: Fall 2009

Course coordinator: Leslie Grunes, 609-570-3865, grunesl@mccc.edu

Information resources:

- The library has many books, CDs and videos available.
- The Library Computer Lab has Internet access and MINITAB installed for student use.
- The Learning Center has tutoring and help available to the students.

Course Competencies/Goals:

The student will be able to:

- I conduct in-depth one variable data analysis techniques on an individualized student data set
- II. conduct in-depth bivariate data analysis stressing regression and correlation techniques on a personally chosen data set
- III enter data once into a calculator (scientific or graphing) and then calculate one-variable or two-variable statistics
- IV take a random sample from a population in different ways, or randomly assign experimental units to treatments in different ways
- V compute probabilities of binomial (discrete) and normal (continuous) probability distributions.
- VI Use the normal distribution to compute probabilities of the sample means.
- VII construct and interpret a confidence interval for the population mean or population proportion
- VIII test hypotheses in drawing conclusions about the population mean or population proportion from a random sample.

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals

Goal 1. Communication. Students will communicate effectively in both speech and writing.

Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

MCCC Core Skills

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal E. Computer Literacy. Students will use computers to access, analyze, or present information, solve problems, and communicate with others.

Units of study in detail.

UNIT I ONE VARIABLE DATA ANALYSIS

- A. The student will distinguish between a quantitative variable or categorical variable for analysis. (CG I, GE 1,2,4, A,B,E)
- B. The student will input a data set into a MINITAB worksheet or use an already existing MINITAB data set. The student will choose one quantitative variable and one categorical variable for analysis. (CG I, GE 4, E)
- C. The student will use MINITAB to graph (Categorical Variable) pie chart, bar chart, dot plot and (Quantitative Variable) stem-and-leaf, histogram, box plot, and side by side box plot and calculate descriptive statistics for quantitative variable for all observations and for each value of categorical variable. (CG I, GE 4, E)

- D. The various measures of central tendency are the mean, median. The student will know the definition of each of these measures and will be able to calculate them. (CG I, III, GE 2, B)
- E. The various measures of variation are the range, variance, and standard deviation, interquartile range The student will know the definition of each of these measures and will be able to calculate them. (CG I, III, GE 2, B)
- F. The measurements of position such as quartiles, percentiles will be presented and the student will find the position given a data value or find the data value given the position. (CG I, III, GE 2, B)
- G. The student will know various distributional shapes (skew to right, skew to left, symmetric or uniform) (CG I, GE 1, 2, A, B)
- H. The student will be able to calculate intervals for mild or extreme outliers. (CG I, GE 1,2, A, B)
- I. The student will write a paper analyzing the chosen quantitative variable and categorical variable. (CG I, III, GE 1, 2, 4, A, B, E)

UNIT II **SAMPLE REGRESSION AND CORELLATION**

- A. Using MINITAB, the student will graph a scatter plot, graph the regression line, and graph residual plots for two quantitative variables and calculate statistics for an individual data set of pairs of observations. (CG II, GE 4, A)
- B. The student will understand the following aspects in examining sample linear regression line and write a paper: (CG II, GE 1, 2, 4, A, B, E)
 - 1. causation
 - 2. various sources of variation (sum of squares)
 - 3. coefficient of determination R^2 : the ratio of explained variation to the total variation.
 - 4 . extrapolation
 - 5. desirable residual plot
 - 6. outliers
 - 7. influential observations
- C. The student will know that correlation coefficient r , which indicates association, measures linear strength and direction and know the properties . The student will know the difference between association and causation (CG II, GE 1, A)

UNIT III **CALCULATIONS**

- A. The student needs to know how to use STAT mode on calculator to calculate summary statistics for both one variable and regression analysis. From the summary statistics, the student substitute into formulas to calculate variance S^2 for one variable get result and substitute into formulas to calculate a and b in the

least regression equation $\hat{y} = ax + b$. (CG I, II, III, GE 2, 4, E)

- B. For a few observations, the student should know to find the above statistics by Hand. (CG I, II, III, GE 2)

UNIT IV

DATA COLLECTION

- A. The student will know the difference between an observational study (association) and designed experiment (causation) (CG IV, GE 1, A)

- B. Sampling (observational study) (CG III, IV, GE 1, 2, 4, A, B)

Know the following designs: sample random sample (SRS) and stratified sample

For each sampling design:

- (1) Identify the population
- (2) Identify the sampling units
- (3) How the random sample is drawn by using random number generator on calculator

- C. Experimental Design (causation) (CG III, IV, GE 1, 2, 4, A, B)

Know the following experimental designs: one factor randomized controlled and randomized block

For each experimental design:

- (1) identify the response variable
- (2) identify experimental units
- (3) the factor
- (4) levels of the factor
- (5) treatments i.e. randomly assigning experimental units to each level
- (6) blocks (If applicable)
- (7) randomization of the experimental units to each treatment

UNIT V

PROBABILITY DISTRIBUTIONS

- A. The student will know the difference between a discrete and continuous distribution. (CG V, GE 1)
- B. The student will calculate the probability of discrete random variables for a specific value or range of values (CG V, GE 2, 4, A, B, C)
- C. For a discrete distribution, the student should know how to calculate the mean μ and the standard deviation σ (CG V, GE 2, 4, A, B, C)
- D. The student will be able to calculate probability for values of the binomial random variable (CG V, GE 2, 4, A, B, C)

- E. The student will be able to calculate the mean and standard deviation for the binomial distribution. (CG V, GE 1, 2, A)
- G. The student will know the characteristics of the normal distribution. (CG V, GE 1, A)
- H. Applications of normal distribution (CG V, VI, GE 1, 2, 4, A, B, E)
 - 1. Standard normal with mean($\mu=0$) and standard deviation($\sigma=1$)
 - 2. Nonstandard Normal $X \sim N(\mu, \sigma)$
 - Case 1: Given the X-interval, find the probability
 - Case 2: Given the Probability(or percentile), find the X-interval.
 - The student should be able to find the solution of both cases by hand, TI 84, or MINITAB.
 - 3. Central Limit Theorem: Given any population of data, for a large random sample of size n, the sampling distribution of \bar{X} is approximately Normal with $\mu_{\bar{X}} = \mu$ and $\sigma_{\bar{X}} = \sigma / \sqrt{n}$.

UNIT VI ESTIMATION OF PARAMETERS AND HYPOTHESIS TESTING

- A. The student should distinguish between a sample statistic and a parameter of a population. (CG I, GE 1)
- B. Define: (CG VII, VIII, GE A)
 - 1. Sample Mean
 - 2. Sample Variance
 - 3. Unbiased Estimator
 - 4. Type 1 or α error
 - 5. Type 2 or β error
- C. Test of Hypothesis: (CG VIII, GE 1, 2, 4, A, B)

The student follows the following procedure for each of the three cases below:

Parameter of interest (μ or p)

Hypotheses (H_0 vs H_a)

Assumptions

Name of test (Z or T)

Test statistic calculation

Obtain rejection region for α error (use table) or
P-value from TI 84 or MINITAB

Make a decision Reject H_0 or do not reject H_0 at α

Case 1 on μ with σ known Test statistic Z

Case 2 on μ with σ unknown Test statistic T

Case 3 on p for Large Sample Test Statistic Z

D. Confidence Intervals (CG VII, GE 1, 2, 4, A, B)

The student will be able to calculate and interpret the confidence interval capturing the mean for σ known by using a Z distribution.

The student will be able to calculate and interpret the confidence interval capturing the mean for σ unknown by using a T distribution

. The student will be able to calculate the confidence interval for the population proportion for a large sample by using Z distribution

EVALUATION

The course evaluation will be up to the professor's discretion. The student will be evaluated on examinations and written reports. MINITAB is used for one variable data analysis and sample regression and correlation.

A possible breakdown for determining a final grade could be as follows:

Written reports/projects (2) --- 30%
Written examinations (3) -----70%

Academic Integrity Statement:

Mercer County Community College is committed to Academic Integrity – the honest, fair, and continuing pursuit of knowledge, free from fraud or deception. Students should never:

- Knowingly represent the work of others as their own
- Knowingly represent previously completed academic work as current
- Fabricate data to support academic work
- Use or obtain unauthorized assistance in the execution of any academic work
- Give fraudulent assistance to other students
- Unethically use technological means to gain academic advantages

Violators of the above actions will be penalized, and offenders will be reported to the Academic Integrity Committee. Please see the Student Handbook on Academic Integrity for additional details.