WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline – STAT 360**

**Title:** Regression Analysis

**Number of Credits:** 3

**Catalog Description:** Simple linear regression, multiple regression, hypothesis testing, analysis of residuals, stepwise regression. Interpretation of computer output will be emphasized. Prerequisites: STAT 310 Offered Yearly..

**Possible Textbooks:**

* *Applied Regression Including Computing and Graphics* by R. Dennis Cook and Sanford Weisberg, Wiley Publishing.
* *Applied Linear Regression* by Sanford Weisberg, Wiley Publishing.

**Topics Covered:**

1. Review of Statistical Prerequisites
2. Graphical Summaries
3. Statistical Inference
4. Introduction to Regression
   1. Conditional Distributions
   2. Mean & Variance Functions
   3. Smoothing
   4. Bivariate Distributions
   5. Two-Dimensional Plots
5. Simple Linear Regression
   1. Model Equation & Assumptions
   2. Least Squares Estimation
   3. Inference for Regression Parameters
   4. ANOVA
6. Model Comparison
7. Diagnosing Assumption Violations
8. Introduction to Multiple Linear Regression
   1. Model Equation & Assumptions
   2. Three-dimensional Plots
   3. Fitting the Model
   4. Fitting the Model using Matrix Computations
   5. Problems with Multiple Linear Regression
9. Partial Coefficient of Determination and Correlation
10. Inference for Linear Combinations of Regression Coefficients
11. Regression Models with Categorical Predictors
    1. Fitting the Model
    2. Predictors with More Than Two Levels
12. Model Selection
    1. R2
    2. Adjusted R2
    3. Mallow's C Statistic
    4. Forward, Backward and Stepwise Regression
13. Outliers & Influential Observations
    1. Leverage
    2. Studentized Residuals
    3. Cook's D
14. Remedial Measures
    1. Adding Higher Powered Terms
    2. Transforming the Predictor Variable
    3. Transforming the Response Variable
    4. Power Curves
    5. Box-Cox Method
    6. Weighted Least Squares
15. Logistic Regression (Time Permitting)

**Listing of Sections to be Covered:** Not applicable to this course, since there is no standard textbook. Chosen sections of any text should correspond to the topics outlined above.

**Remarks:** None.

**Approximate Pace of Coverage:** Not Applicable.

**Method of Instruction:** Methods may include lecture, case studies, discussion, group work, problem solving sessions, computer sessions, and discussion of computer output.

**Evaluation Procedure:** Assessments will vary in style and may include written exams, quizzes, homework assignments, labs, and group projects.

**Minnesota Transfer Curriculum:** None

**MnSCU Learning Outcomes:**

* This course will promote a student’s ability to identify research questions that may be answered using regression analysis and to translate these questions into the appropriate analysis procedure. A successful student will be knowledgeable of the statistical methods presented, and be able to properly obtain and use these methods.
* This course will promote a student’s ability to model and 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 answer real-world research questions with regression models and approach such problems with confidence.
* This course will promote a student’s ability to recognize the underlying model assumptions behind regression models and employ methods for checking these assumptions. A successful student will be able to properly apply model diagnostics when solving a particular research question.
* This course will promote a student’s ability to analyze data and summarize the results in a meaningful way. You should have acquired some of these skills in your introductory statistics course, but in this class you will focus even more on effectively communicating results to persons without any specialized statistical training. A successful student will be able to effectively communicate results to both non-statisticians and statisticians.
* This course will promote a student’s ability to use appropriate technology to carry out a regression analysis. A successful student will be able to use the software packages SAS and Arc for data analyses.

**Possible Computer Software:**

* JMP
* R
* SAS
* Arc

**Last Revised:** Spring 2014 by the Statistics Subgroup.