STA 522 – Regression Analysis
Course Syllabus

Course description: Linear regression, non-linear models, multiple regression.

Credit hours: 3

Course Prerequisites and Corequisites: STA 520 and MTH 317

(The following outline is subject to change and may not be in this particular order.)

Course outline: Approximate time spent

- **Simple Linear Regression** 20%
  - Scatterplots
  - Ordinary Least Squares Estimation
    - Normal Equations
    - Properties of Least Squares Estimators
    - Derivation of Least Squares Estimators
  - Variance Estimation
  - Model Assessment
    - Cochran's Theorem
    - F-test, t-test
    - Coefficient of Determination
  - Transformations
  - Confidence Intervals and Hypothesis Tests for
    - Slope
    - Intercept
    - Mean Response given X
  - Prediction and Prediction Intervals
  - Matrix Representation
- **Multiple Linear Regression**
  - Matrix Representation 30%
  - Ordinary Least Squares Estimation
    - Normal Equations
    - Properties of Least Squares Estimators
    - Derivation of Least Squares Estimators
  - Variance Estimation
  - Model Assessment
    - F-test
    - Coefficient of Multiple Determination
  - Transformations
  - Confidence Intervals and Hypothesis Tests for
    - Partial Slopes
    - Intercept
    - Mean Response given X
  - Prediction and Prediction Intervals

- **Regression Diagnostics** 25%
  - Residual Analysis
    - Normality
    - Constant Variance
    - Independence
  - Outliers and Influential Points
    - Outlier Tests
    - Cook's Distance
- **Variable Selection** 15%
  - Multi-colinearity
  - Stepwise Regression Methods
- **Introduction to Special Topics in Regression** 10%
  - Polynomial Regression
  - Logistic Regression
  - Poisson Regression
  - Non-Linear Regression

Student Learning Outcomes (SLO): At the end of STA 522, a student who has studied and learned the material should be able to:

1. Build a simple linear regression model. [PLO: 2, 3]
2. Assess the strength and appropriateness of a simple linear regression model. [PLO: 2, 3]
3. Interpret the following of a simple linear regression model: slope, intercept, point predictions, prediction intervals, and confidence intervals. [PLO: 2,5]
4. Perform the first three bullets in the context of a multiple regression model. [PLO: 2, 3, 5]
5. Demonstrate an understanding of the least squares estimators. [PLO: 1]
6. Demonstrate an understanding of the matrix representation of a Simple or Multiple Regression Model. [PLO: 2]
7. Use residuals to check model assumptions. [PLO: 2, 3]
8. Identify outliers and influential points. [PLO: 2, 3]
9. Use transformations to successfully (if possible) meet model assumptions. [PLO: 2, 3]
10. Use a statistical computer package to build a regression model and assess its strength/appropriateness. [PLO: 2, 3, 5]

Program Learning Outcomes (PLO):

Students graduating from SFASU with an M.S. degree and a major in statistics will demonstrate:

1. A command of core probability and statistical concepts through major definitions and theorems. **[*Concepts*]** (Probability and Statistical Inference)
2. Strategic competence in formulating a standard probabilistic/statistical model for a given problem. **[*Modeling*]** (Model Choice and Model Interpretation)
3. Skill in using statistical software in order to process and interpret data. **[*Data Processing*]** (Computational Skills and Model Validation)
5. Proficiency in communicating probability and statistics in a format appropriate to expected audiences. **[*Communication*]** (Written Communication, Oral Communication)

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