University of Sri Jayewardenepura

Department of Statistics

STA 224 2.0 Regression Analysis

Type: Core

Duration: 30 hours

Note: (But actual number of hours allocated in the master time table is 26.25 hours.

(105 min. per week * 15 weeks = 26.25 hrs))

Credit Value: 2.0

Pre-requisites: STA 114 2.0 Probability and Distribution Theory I

STA 123 2.0 Probability and Distribution Theory II

STA 113 2.0 Descriptive Statistics

STA 213 2.0 Statistical Inference

Objectives:

To identify variables that would influence a response variable and estimate a reliable statistical relation to represent the association among variables for prediction and control purposes.

Course contents:

1. Introduction to Regression
   1.1 What is regression analysis?
   1.2 Applications of regression analysis
   1.3 Steps in regression analysis

2. Simple Linear Regression
   2.1 Introduction
   2.2 Notation for data used in regression analysis
   2.3 Covariance and correlation
   2.4 The simple linear regression model
   2.5 Parameter estimation
   2.6 Interpretation of regression coefficients
   2.7 Properties of least squares estimators
   2.8 Test of hypotheses

2.9 Confidence intervals
2.10 Predictions
2.11 Measuring the quality of fit
2.12 Regression line through the origin

3. Multiple Linear Regression
   3.1 Introduction
   3.2 Parameter estimation
   3.3 Interpretation of regression coefficients
   3.4 Test of hypotheses
   3.5 Confidence intervals
   3.6 Prediction
   3.7 Multicollinearity

4. Model Adequacy Checking
   4.1 Introduction
   4.2 Residual analysis
   4.3 Lack of fit of the regression model

5. Transformation of Variables
   5.1 Introduction
   5.2 Variable stabilization transformations
   5.3 Transformations to linearize the model
   5.4 Analytical methods for selecting a transformation

6. Qualitative Variables as Predictors

7. Collinearity and Variable Selection Procedures
   7.1 Introduction
   7.2 Evaluation all possible equations
   7.3 Variable selection procedures
      7.3.1 Forward selection procedure
      7.3.2 Backward elimination procedure
      7.3.3 Stepwise method

Learning Outcomes: At the end of the course, you will be able to:

- Use simple linear regression for building empirical models.
- Understand how the method of least squares is used to estimate the parameters in a linear regression model.
- Analyze residuals to determine whether the regression model is an adequate fit to the data or whether any underlying assumptions are violated.
- Test statistical hypotheses and construct confidence intervals on regression model parameters.

- Use the regression model to predict a future observation and to construct an appropriate prediction interval on the future observation.
- Use simple transformations to achieve a linear regression model.
- Use multiple regression techniques to build empirical models to engineering and scientific data.
- Understand how the method of least squares extends to fitting multiple regression models.
- Assess regression model adequacy.
- Test hypotheses and construct confidence intervals on the regression coefficients.
- Use the regression model to estimate the mean response and to make predictions and to construct confidence intervals and prediction intervals.
- Use indicator variables to model categorical regressors.
- Use stepwise regression and other model building techniques to select the appropriate set of variables for a regression model.

Reference Text Books:

- Introduction to Linear Regression Analysis, D. Montgomery and E. Peck, Wiley, 2012
  ISBN: 978-0-470-54281-1

- Applied Linear Statistical Models, Michael Kutner, Christopher Nachtsheim, John Neter, William Li, Wiley
  ISBN-13: 978-0073108742

Method of Assessment:

1. Mid Semester Examination – 20%
2. End Semester Examination – 80%

Lecturer in charge: Ms. T. S. Talagala

Second Semester, 2015 – Starting on 13, July 2015