

Departmental Syllabus
Math 4040 -- Statistics and Probability

Textbook: Applied Statistics and Probability for Engineers (Third Edition), by Montgomery and Runger

Prerequisites: MATH 4030 with a grade of "C" or better.

Calculators: No specific calculator required.

Course Description: A thorough investigation of more advanced applications in statistics including joint distributions, linear regression, multiple regression, design of experiments for a single factor and multiple factors, analysis of variance, nonparametric statistics, and statistical quality control.

Topics and sections to be covered:

- 5.1 Two Discrete Random Variables
- 5.2 Multiple Discrete Random Variables
- 5.3 Two Continuous Random Variables
- 5.4 Multiple Continuous Random Variables
- 5.5 Covariance and Correlation
- 5.6 Bivariate Normal Distribution
- 5.7 Linear Combinations of Random Variables

- 11.1 Empirical Models (review)
- 11.2 Simple Linear Regression (review)
- 11.3 Properties of the Least Squares Estimators
- 11.5 Hypothesis Tests in Simple Linear Regression
- 11.6 Confidence Intervals
- 11.7 Prediction of New Observations
- 11.8 Adequacy of the Regression Model
- 11.9 Transformations to a Straight Line
- 11.11 Correlation (review)

- 12.1 Multiple Linear Regression Model
- 12.2 Hypothesis Tests in Multiple Linear Regression
- 12.3 Confidence Intervals in Multiple Linear Regression
- 12.4 Prediction of New Observations
- 12.5 Model Adequacy Checking
- 12.6 Aspects of Multiple Regression Modeling

- 13.1 Designing Engineering Experiments
- 13.2 The Completely Randomized Single-Factor Experiment
- 13.3 The Random Effects Model

- 13.4 Randomized Complete Block Design
 - 14.1 Introduction
 - 14.3 Factorial Experiments
 - 14.4 Two-Factor Factorial Experiments
 - 14.5 General Factorial Experiments
 - 14.7 2^k Factorial Designs
 - 14.8 Blocking and Confounding in the 2^k Design
 - 14.9 Fractional Replication of the 2^k Design

- 15.1 Introduction
- 15.2 Sign Test
- 15.3 Wilcoxon Signed-Rank Test
- 15.4 Wilcoxon Rank-Sum Test
- 15.5 Nonparametric Methods in the Analysis of Variance

- 16.1 Quality Improvement
- 16.2 Statistical Quality Control
- 16.3 Statistical Process Control
- 16.4 Introduction to Control Charts
- 16.5 \bar{X} and R or S Control Chart
- 16.6 Control Charts for Individual Measurements
- 16.7 Process Capability
- 16.8 Attribute Control Charts
- 16.9 Control Chart Performance
- 16.10 Cumulative Sum Control Chart
- 16.11 Other SPC Problem-Solving Tools