

**COURSE NUMBER:** MA1670

**COURSE TITLE:** Statistics

**COURSE DESCRIPTION:**

This course introduces students to the basic principles of probability and statistics, and the decisions that can be made using statistics. In this course the student will explore descriptive statistics, elementary probability, discrete and continuous probability distributions, sampling distributions, hypothesis testing, chi-square distribution, analysis of variance, linear regression and correlation, and multiple linear regression.

The student will have the opportunity to apply and interpret the results of a variety of statistical techniques from both descriptive and inferential statistics; to apply the fundamental concepts in statistics including sampling, experimentation, variability, distribution, association, causation, estimation, confidence, hypothesis testing, and significance; to critically review and analyze statistical arguments found in the popular press and in scholarly journals; and to appreciate the relevance and importance of statistics

**PREREQUISITES:** None

**CO-REQUISITES:** None

**CREDIT VALUE:** Four (4)

**COURSE HOURS PER WEEK:** Four (4)

**LAB HOURS PER WEEK:** One (1)

**SUGGESTED TEXT(S):**

One of:

Johnson, R., Miller, I., and Freund, J. (2004). *Miller and Freund's Probability and Statistics for Engineers* (7<sup>th</sup> ed.). Toronto: Pearson Education. ISBN-10: 0131437453; ISBN-13: 9780131437456

Larson, R and Farber, E. (2007). *Elementary statistics: Picturing the world* (4<sup>th</sup> ed.). Toronto: Pearson Education. ISBN-10: 0132424339; ISBN-13: 9780132424332

Lind, D.A., Marchal, W.G., and Wathen, S.A. (2009). *Statistical techniques in business and economics* (14<sup>th</sup> ed.). Toronto: McGraw-Hill. ISBN-10: 0077309421; ISBN-13:

9780077309428

Lind, D.A., Marchal, W.G., Wathen, S.A., and Waite, C.A. (2009). *Basic statistics for business and economics* (3<sup>rd</sup> Cdn. ed.). Toronto: McGraw-Hill. ISBN-10: 0070980357; ISBN-13: 9780070980358

Triola, M.F. (2008). *Elementary statistics* (11<sup>th</sup> ed.). Toronto: Pearson Education. ISBN-10: 0321500245; ISBN-13: 9780321500243

## **LEARNING RESOURCES:**

Deal, K. (2007). *A Guide to SPSS 14.0 for Windows* (Paperback ed.). Toronto: McGraw-Hill. ISBN-10: 0070983763

Graphing calculator

Student workbooks and on-line student success centers as provided by the publishers for each text.

## **COURSE OUTCOMES:**

Upon successful completion of this course, the learner will be able to:

1. Compute and interpret statistical analysis for program applications
2. Use statistical packages such as Excel or SPSS, or a graphing calculator, to analyze data for program applications
3. Explain descriptive and inferential statistics
4. Construct and interpret hypothesis tests for program applications
5. Compute and interpret the regression equation representing the relationship between dependent and independent variables

## **MAJOR TOPICS:**

- 1.0 Introduction to Statistics
- 2.0 Descriptive Statistics
- 3.0 Elementary Probability
- 4.0 Discrete Probability Distributions
- 5.0 Continuous Probability Distributions
- 6.0 Sampling Distributions
- 7.0 Hypothesis Testing
- 8.0 Analysis of Variance
- 9.0 Chi-square Distribution
- 10.0 Linear Regression and Correlation
- 11.0 Multiple Linear Regression

## **LEARNING OBJECTIVES:**

### **1.0 Introduction to Statistics**

- 1.1 Define: statistics, data, population, sample and census
- 1.2 Differentiate between descriptive and inferential statistics
- 1.3 Identify the types of data and the characteristics of each type

### **2.0 Descriptive Statistics**

- 2.1 Define frequency distributions, frequency, relative frequency, classes, and class limits
  - 2.1.1 Construct a frequency distribution, a relative frequency distribution, and a cumulative frequency distribution
- 2.2 Discuss graphical techniques
  - 2.2.1 Define and describe the shape of a distribution
  - 2.2.2 Construct and analyze a histogram, a frequency polygon, a bar chart, a pie chart and an ogive
  - 2.2.3 Explain how graphs can be misused
- 2.3 Discuss numerical techniques
  - 2.3.1 Compute and explain the roles of mean, median, and mode as ways of measuring central tendency
  - 2.3.2 Compute and discuss range, variance, and standard deviation
  - 2.3.3 Discuss measures of position
    - 2.3.3.1 Define and calculate percentile and quartiles
    - 2.3.3.2 Explain relative standing
    - 2.3.3.3 Explain and compute z-score
- 2.4 Differentiate between grouped data and ungrouped data
  - 2.4.1 Calculate the mean and standard deviation for grouped data

### **3.0 Elementary Probability**

- 3.1 Explain probability, experiment, event, outcome and sample space
  - 3.1.1 Explain the methods for assigning probabilities
- 3.2 Apply the formula to determine the number of probable outcomes of an experiment
- 3.3 Differentiate between permutations and combinations
  - 3.3.1 Compute permutations and combinations using the factorial formula
- 3.4 Compute the probability of an event occurring using addition rules
  - 3.4.1 Assess whether events are mutually exclusive or not

- 3.5 Define conditional probability
  - 3.5.1 Demonstrate how conditional probability affects probability calculations
  - 3.5.2 Compute the probability of an event occurring using conditional probability rules
  - 3.5.3 Define independent events
  - 3.5.4 Assess whether events are statistically independent
- 3.6 Compute probabilities using the multiplication rule
  - 3.6.1 Explain the condition for the use of the simplified multiplication rule
- 3.7 Compute probabilities using Bayes' Theorem
  - 3.7.1 Construct a tree diagram and compute probabilities of events occurring

#### **4.0 Discrete Probability Distributions**

- 4.1 Differentiate between a discrete random variable and continuous random variable
  - 4.1.1 Compute the mean, variance, and standard deviation of a discrete probability distribution
- 4.2 Describe binomial distribution
  - 4.2.1 Explain the properties of the mean and standard deviation of the binomial distribution
  - 4.2.2 Compute the mean and standard deviation of the binomial distribution problems

#### **5.0 Continuous Probability Distributions**

- 5.1 Sketch and state the properties of the normal distribution
- 5.2 Compute probabilities for program applications using standard normal distribution
- 5.3 Use the normal curve to find approximate solutions to binomial distribution calculations

#### **6.0 Sampling Distributions**

- 6.1 Define sampling
- 6.2 Differentiate between random sampling, stratified random sampling, and cluster sampling
  - 6.2.1 Prepare a sampling plan
- 6.3 Discuss the distribution of sample means, proportions and the Central Limit Theorem
  - 6.3.1 Compute and explain the standard error of the means and proportions
  - 6.3.2 Apply the central limit theorem to make predictions about and calculate

- probabilities for sample means and sample proportions
- 6.3.3 Apply the Central Limit Theorem to construct confidence intervals for sample means and sample proportions
- 6.3.4 Compute sample size for sampling data for an estimation of mean or proportion

6.4 Explain z-test and t-test

## **7.0 Hypothesis Testing**

- 7.1 Explain the purpose of hypothesis testing
- 7.2 Apply statistical hypothesis testing using sample data to accept or reject hypotheses about some aspect of a probability distribution
  - 7.2.1 Compute p-values for hypothesis testing of large samples
  - 7.2.2 Differentiate between the two types of errors which can be made during hypothesis testing
  - 7.2.3 Explain and compute the level of significance
  - 7.2.4 Conduct hypothesis tests on means and proportions for one and two large samples
  - 7.2.5 Conduct hypothesis tests on means and proportions for one and two small samples

## **8.0 Analysis of Variance**

- 8.1 Introduction
  - 8.1.1 Describe the method of analysis of variance
- 8.2 One-way or single-factor analysis of variance
  - 8.2.1 Analyze the technique known as single-factor analysis of variance for comparing several sample means
  - 8.2.2 Discuss how to set up analysis of variance (ANOVA) charts and develop formulas to use with ANOVA charts
  - 8.2.3 Discuss the F-distribution for comparing variances
  - 8.2.4 Apply the F-distribution to help determine whether differences in sample means are significant
- 8.3 Two-way analysis of variance
  - 8.3.1 Analyze two-way analysis of variance (ANOVA) tables where two factors may affect the sample means

## **9.0 Chi-Square Distribution**

- 9.1 Describe the properties and uses of the Chi-Square Distribution
- 9.2 Discuss the Goodness of Fit test
  - 9.2.1 Perform the chi-square test to determine whether more than two

population proportions can be considered equal  
9.2.2 Perform the chi-square test to determine whether an observed collection of data is well described by a specified probability distribution

9.3 Perform the Chi-Square Test to determine whether two classifications of the same data are independent of each other

## **10.0 Linear Regression and Correlation**

- 10.1 Describe the applications of linear regression and correlation
- 10.2 Distinguish between independent and dependent variables
- 10.3 Construct scatter diagrams to determine if two variables are related or linearly correlated
- 10.4 Define linear correlation
- 10.5 Compute the coefficient of correlation and use it to determine the strength of linear relationships between variables
- 10.6 Analyze the reliability of the coefficient of correlation through hypothesis testing
- 10.7 Compute the coefficients of a linear regression line and use the equation to predict the value of dependent variable when given the value of independent variables
- 10.8 Interpret the slope of the linear regression equation
- 10.9 Compute and interpret the standard error estimate and use it to analyze the predictability of the regression line
- 10.10 Construct confidence intervals for regression estimates given large samples

## **11.0 Multiple Linear Regression**

- 11.1 Compute the coefficients of a multiple regression line and use the equation to predict the value of a dependent variable when given the value of independent variables
  - 11.1.1 Interpret the coefficients of the multiple regression equation
  - 11.1.2 Conduct a test of hypothesis to determine if the regression coefficients differ from zero
  - 11.1.3 Conduct a test of hypothesis on each of the regression coefficients

### **EVALUATION:**

Assignments / projects	20%
Term tests	40%
Final exam	40%

This course is supplementary eligible.

**DATE DEVELOPED:** March 6, 1998

**DATE REVIEWED:**

**REVISION NUMBER:** 2

**DATE REVISED:** September 2012

*Note to instructor: Check PIRS to ensure this outline is the most current version*