Managerial Statistics

Summer 2019

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Textbook: Statistics for Business Decision Making and Analysis by Robert Stine and Dean Foster, Pearson Publisher

Course Description:

The course is designed to achieve an understanding of fundamental notions of data presentation and analysis and to use statistical thinking in the context of business problems. The course deals with modern methods of data exploration (designed to reveal unusual or problematic aspects of databases), the uses and abuses of the basic techniques of inference, and the use of regression as a tool for management and for financial analysis. The potential ethical issues related to each topic will be reviewed. Socially and environmentally relevant data will be utilized throughout the course.

Session 1

I. Data Analysis

A. Data collection
   1. distinction of population and sample
   2. types of data: nominal, ordinal, interval, and ratio scaled data simplicity sometimes reduced to just qualitative and quantitative.
   3. importance of data quality and use of appropriate sampling mechanisms

B. Summary statistics and graphical methods
   1. histogram, stem-and-leaf plot, box plot
   2. measures of location: mean, median, mode
   3. measures of scale: standard deviation, range, interquartile range
   4. scatter plots
II. Applied probability and inference
   A. Basic concept of probability
      1. algebra of events
      2. definition of probability: equally likely frequency theory, personal probability
      3. conditional probability and independence

Session 2

B. Random variable and their properties
   1. definition of random variable
   2. probability distribution function
   3. mean, variance, and standard deviation of a random variable
   4. covariance and correlation of two random variables

Session 3

C. Important specific distributions
   1. discrete uniform distribution
   2. hypergeometric distribution
   3. binomial distribution
   4. Poisson distribution
   5. continuous uniform distribution
   6. Gaussian (normal) distribution

Session 4

D. Point and interval estimation
   1. Central Limit theorem
   2. Confidence interval for the mean μ.
   3. Confidence interval for the binomial proportion p

Session 5

E. Hypothesis testing: practical and statistical significance
   1. structure of test: null and alternative hypotheses, Type I and II errors, practical significance of rejection of null hypothesis
   2. testing hypotheses about μ : z-test, t-test
   3. testing hypotheses about p : z-test
   4. graphical testing: control charts

Session 6

E. Hypothesis testing: practical and statistical significance (continued from Session 5)
   1. testing hypotheses about μ1 and μ2 : z-test, t-test
   2. testing hypotheses about p1 and p2 : z-test
   3. paired-sample test

Session 7       Midterm Exam
Session 8

F. Analysis of discrete data
   1. nominal and ordinal discrete data
   2. contingency tables
   3. tests of independence

Session 9

III. Regression analysis
   A. Simple linear regression: assumptions, modeling, inference
      1. the linear model: graphical (scatter plot) and theoretical (model building) analysis
      2. the principal of least squares
      3. assumption of linear least square regression
      4. inference in linear regression: t-tests, F-test, R2
      5. prediction
      6. checking assumptions in regression: examination of residuals, diagnostics, and residual plots

Session 10

B. Multiple regression
   1. the multiple regression model
   2. t-tests versus the F test
   3. residual analysis
   4. interpretation of multiple regression coefficient
   5. multicollinearity

Session 11

C. Other regression models and problems
   1. transformations
   2. model selections

Session 12 Additional topics on regression

Session 13 Final Exam

Grading Plan

We will have a midterm and a final exam. Exams will be open book and open notes. The course grade will be based on the following components and weights:

- Classroom Contributions: 5%
- Problem sets: 15%
- Midterm: 40%
- Final: 40%