Applied Statistic with R

Fall 2019, ASDS, YSU

Midterm 1 Material Coverage

Exam Time and Place: October 29, 18:30 - 23:00, #241 YSU MMF

1 Descriptive Statistics

1. Introduction
   - Populations and Samples; Observation, Variable and Parameter; Statistics (numerical characteristic of a Sample)
   - Sampling: Representative Sample; Sampling Methods (Systematic, Stratified, Cluster)
   - Types of Variables (Features)
   - Measurement Levels
2. Exploratory Data Analysis for Univariate Data: Graphical Summaries
   - Frequency and Relative Frequency Tables
   - BarPlot, Frequency Polygon
   - Empirical Distribution Function
   - Frequency, Relative Frequency and Density Histograms
   - Stem-and-Leaf Plots
3. Exploratory Data Analysis for Univariate Data: Numerical Summaries
   - Order Statistics (Ranks)
   - Statistics for the central tendency
     - The Sample Mean, Trimmed Mean, Weighted Mean, Winsorized Mean
     - The Sample Median
     - The Sample Mode
   - Statistics for the Spread/Variability
     - Deviations (from the Mean, from the Median), Absolute Deviations
     - The Range
     - The Sample Variance and Standard Deviation (with n or $n-1$ in the denominators)
     - Properties of the Sample Variance
     - The Mean Absolute Deviation (MAD) from the Mean or Median

4. Exploratory Data Analysis for Univariate Data: Quantiles and BoxPlots
    - Sample Quartiles
    - The InterQuartile Range, IQR
    - BoxPlot
    - Outliers (BoxPlot Method)
    - Sample Quantiles
    - Theoretical Quantiles
5. Exploratory Data Analysis for Bivariate Data
    - ScatterPlot
    - Q-Q Plot (Data vs Data, Data vs Distribution, Distribution vs Distribution)
    - Sample Covariance and the (Pearson's) Correlation Coefficient
    - Properties of Sample Covariance and Correlation Coefficient
    - Spearman's ρ and Kentall's τ
6. Probability Refresher
    - R.V.s and their main characteristics
    - Important Discrete and Continuous Distributions
7. Convergence of Random Variables
    - Convergence almost sure
    - Convergence in Probability
    - Convergence in Quadratic Mean
    - Convergence in Distributions
    - Relationship between the convergence types
    - Properties of Convergent Sequences of RVs
    - Standardization; the Weak and Strong LLN
    - The CLT
8. Parametric Inference and Point Estimation
    - Parametric Modeling, The Problem of the Point Estimation
    - Statistics and Estimators, Estimates
    - MSE and Comparison of Estimators
    - Properties of Estimators:
        - Bias, Unbiasedness, Asymptotic Unbiasedness,
        - Consistency, Strong Consistency, Weak Consistency