Alexandria University

Faculty of Engineering

Computer and Systems Engineering

First Year

CS 111: Probability Theory and its Applications

Lab 6

Overview

In this lab, you will apply R concepts that you have learnt in the previous labs.

1- Loading Data

You are required to **load the *mtcars* dataset** from the built-in datasets in R. You should also **discover the dataset** (Number of observations, number of variables, other info…) and the values of each column using the learnt techniques.

2- Extracting Information

You are required to:

- Display **the head** of each type of transmission -manual and automatic- separately.
- Display the top 10 cars according to:
  - Displacement
  - hp
  - drat

  using 2 methods.

- Display cars whose *mpg* is **above average only**.
- What is the best type of chart to describe each feature of the mtcars dataset? **Plot** each chart type using R and **state the reason** behind each choice.
- **Plot the boxplots** for the following features: *disp*, *hp* and *qsec*. Extract the **3 main percentiles**. What can you deduce?

3- Distributions

A. Assume that the weight fits a normal distribution. Find the percentage of cars having **3.4 lbs** or more.
B. What is the probability of getting 18 or less manual cars using these 32 observations? Assume that the probability of getting a manual car in an infinite series of cars is equal to the probability of getting a manual car from this dataset.
C. Suppose there are twelve spots in a car parking area. Each spot is suitable for five possible car types, and only one of them fits perfectly. Find the probability of having four or less spots filled with the corresponding car type if the garagist attempts to park in each spot at random.

4- Permutations and Combinations

A. Given that we have a number in the ternary numeral system, this number has 3 digits. Use R to find all the permutations for such number. **Solve using 2 different methods**.
B. Given a set of numbers A = {1, 2, …, 9}, assume you are picking 3 numbers without replacement. Find the probability that you get 3 numbers where the minimum number is 2 and the maximum is 5 using **at least 2 ways**.
*** Use R to calculate all the possible combinations - i.e. unordered - for those 3 numbers.*

5- Bonus

A. Plot Q-Q plot for the mtcars dataset.
B. Extract all the information you can deduce from the plotted graph.

Deliverables

You should submit the following:

- A detailed PDF report of your work every step in your project:
    - Inputs
    - Outputs
    - Any equation used and algorithm (method of solution) followed for each question
    - Comments on the outputs and explanation of the results you get
    - Graphs
    - Answers to the questions asked
    - Any external references
- Well documented source code. Don’t include the source code in your report.