Probability and Statistics Programming (Fall 2020, Sejong University)

Prof. S.M. Riazul Islam

Date: May 13, 2020

Project Title: Demonstrate the Central Limit Theorem (CLT) in Python.

Objective: Reflecting the knowledge of sampling distribution using Python programming.

Tasks Recommended:

A gray-scale image is a two-dimensional array of numbers, each of which represents the corresponding pixel intensity. You can obtain this array of numbers (i.e. image read) using various python packages.

Consider the supplied "lena_gray.gif" gray-scale image as the population. Based on the population, you need to implement the following tasks:

TASK1: Find out the population size n, population mean (μ), population variance (σ^2), population range, minimum number, maximum number, population mode, and population median.

TASK2: Find out the histogram of the population. Comment on the population distribution.

TASK3: Investigate the histogram by changing the number of bins to 10, 100, and 1,000. Provide your observations.

TASK4: Demonstrate the central limit theorem (i.e., the distribution of the sampling mean will approach towards the normal distribution with the mean μ and variance σ^2/n as the sample size increases). Recommended sample sizes are 5, 10, 20, 30, 50, 100. In addition to any content that you think appropriate for this demonstration, you will include various graphical representations such as the respective histogram for each sample size.

Project Report Preparation:

- Include a brief discussion on the central limit theorem and its importance.
- Include each TASK sequentially
- Include the Python code used to do the TASKs.
- Include all the graphs that you have found and think appropriate to demonstrate the TASKs.

Instructions:

1. You should upload the project report in Sejong University Blackboard after you log-in with your ID

2. **Upload a single PDF file. Any other formats are not allowed. Multiple files are not allowed. Compressed/Zip files are now allowed.**

3. **Report submission over e-mail will not be considered.**

4. Your report should be presented well enough and should be readable without any difficulty.

5. Your report should have a title page containing relevant information including Project Title, Student Name, Student number, Date of Submission, Course Name, Semester, etc.

6. Further instructions might be given from time to time via Blackboard notification.

7. Report Submission **Deadline**: June 19, 2020 (11.30 PM, Friday).

Special Note on Q&A

1. If you have any questions, you can write me to my e-mail address: islam.smriaz@gmail.com. However, **you must send me your e-mail within the time period from May 25, 2020 to May 30, 2020**; not before and not after.
2. When writing the email, follow the e-mail structure as I have instructed in the first lecture (see the Lecture Slides 1).