

CENG 222
Probability and Statistics
HOMEWORK 3
Pseudo-random Number Sampling

DUE DATE: 28.04.2022 - 23:55

You are expected to implement the following experiments in Python and answer the corresponding questions in a report. For random number generation, you are **ONLY** allowed to use **numpy.random.rand()** function with **no parameters**.

Simulation:

You are expected to generate a random variable X which has the following cumulative distribution function: $F(x) = x^2$, for $0 \leq x \leq 1$

- a) Create 50000 samples of X using the Inverse Transformation method. At each step, store the generated variables u , x and the updated average and variance of X in the given arrays.

At the end:

- 3 figures for some plots are already implemented. DO NOT change them.
- Plot the average value of X that you calculated throughout the experiment as Figure 4.
- Plot the variance of X that you calculated throughout the experiment as Figure 5.

In your report:

- Inspect the existing plots and comment on them. What do Figure 1, Figure 2 and Figure 3 show?
- Calculate the expected value and variance of X .
- Compare your results with the simulation outputs in Figures 4 and 5.

- b) Create 50000 samples of X using the Rejection method. At each step, store the generated variable x and the updated average and variance of X in the given arrays.

At the end:

- 2 figures for some plots are already implemented. DO NOT change them.
- Plot the average value of X that you calculated throughout the experiment as Figure 8.
- Plot the variance of X that you calculated throughout the experiment as Figure 9.

In your report:

- Inspect the existing plots and comment on them. What do Figure 6 and Figure 7 show?
- Compare your results in (a) with the simulation outputs in Figures 8 and 9.

Submission Rules:

1. You should submit your assignments through TEAMS until due date.
2. You have to submit one zipped file including one file for your code (**py**) and one file for your report (**pdf**).
3. Your homework should be named as **CENG222_HW3_studentID.zip**
4. Write your **student ID** both in your code and report files.