

## Statistical Methods for Data Science

### Mini Project 1

Conduct a Monte Carlo simulation study using R to obtain the answer for Exercise 4.6. Some of you had found the theoretical calculation in that problem difficult. So this is an alternative. Your simulation study must involve/address the following:

- Simulate the block execution times  $X_1$ ,  $X_2$  and  $X_3$ . Use the simulated values to simulate  $X$ , the execution time of the whole program.
- Repeat the previous step 10,000 times. This will give you 10,000 draws from the distribution of  $X$ .
- Make a histogram of the draws of  $X$ . Superimpose the density function obtained in Exercise 4.6. Try using the R function ``curve'` for drawing the density. Note what you see.
- Use the draws to estimate  $E(X)$ . Compare your answer with the exact answer obtained in Exercise 4.6. Note what you see.
- Repeat the process of obtaining an estimate of  $E(X)$  five times. Compare each estimate with the exact value. Note what you see.
- Comment on how your results would change if you use 1,000 Monte Carlo replications instead of 10,000. What if you use 100,000 replications? Justify your answers.

#### **Instructions:**

- Due date: Tuesday, September 22.
- Total points = 10
- Submit a typed report.
- You can work on the project either individually or in a group of no more than two students. In case of the latter, submit only one report for the group, and include a description of the contribution of each member.
- Do a good job.
- You must use the following template for your report:

Mini Project #  
Name  
Names of group members (if application)  
Contributions of group members

Section 1: Give an overview of how you are going to simulate the experiment. Be sure to provide a stepwise description the algorithm in **simple** language.

Section 2: Provide answers to the specific questions asked in the exercise.

Section 3: Provide the R code. Your code must be annotated. No points may be given if a brief look at the code does not tell us what it is doing.