

# CENG 222

## Statistical Methods for Computer Engineering

Spring 2020-2021

### Homework 4

---

Due date: July 13, 2021 23:55PM (GMT+3)

## Problem Description

In a factory, plastics is produced in volumetric chunks. The number of chunks produced daily is a discrete Binomial random variable with parameters  $n = 50$  and  $p = 0.62$ . The weight of material per chunk is a continuous random variable in tons with the following probability density function:

$$f(x) = \begin{cases} 0 & x < 0 \\ 0.07x & 0 \leq x \leq 2 \\ -0.02(x - 4)^2 + 0.22 & 2 < x \leq 5 \\ 0.08(5 - x) + 0.2 & 5 < x \leq 7 \\ -0.04x + 0.32 & 7 < x \leq 8 \\ 0 & \text{if } x > 8 \end{cases}$$

- a. Conduct a Monte Carlo study to estimate the probability that the total weight of the plastics produced by the factory in a week of five workdays exceeds 640 tons, which constitutes a violation of regulations in place. Use  $5n$  and  $p$  as the required distribution parameters. With probability 0.98, your answer should differ from the true value by no more than 0.008. Use Normal approximation to determine the size of your Monte Carlo simulation.
- b. Based on the study in part (a), estimate the total weight,  $X$ , of the plastics produced in five days.
- c. Estimate  $\text{Std}(X)$  and comment on the accuracy of your estimator of  $X$  in part (a).

## Submission

Submit your MATLAB/Octave source code and a short report that describes the Monte Carlo study and answers the questions in parts (a), (b), and (c) as a single zip file in the format `< id_hw4 > .zip` via ODTU-Class before the deadline. Your report can be a Word/Latex pdf document or can be a handwritten and scanned pdf/jpeg file. Late submission is allowed with 20 points per day late submission penalty.