CENG 222

Statistical Methods for Computer Engineering

Spring 2022-2023

Homework IV

Due date: 17.06.2023, Saturday, 23:59

In a busy port, several types of ships dock each day to unload their cargo: bulk carriers, container ships, and oil tankers. Each type of ship has a different average cargo capacity.

The number of bulk carriers that dock in a day is a Poisson random variable with $\lambda = 50$. The cargo weight of each bulk carrier is a gamma-distributed random variable in tons with $\alpha = 60$ and $\lambda = 0.1$.

The number of container ships that dock in a day is a Poisson random variable with $\lambda = 40$. The cargo weight of each container ship is a gamma-distributed random variable in tons with $\alpha = 100$ and $\lambda = 0.05$.

The number of oil tankers that dock in a day is a Poisson random variable with $\lambda = 25$. The cargo weight of each oil tanker is a gamma-distributed random variable in tons with $\alpha = 120$ and $\lambda = 0.02$.

a) Conduct a Monte Carlo study to estimate the probability that the total weight of all the cargo unloaded at the port in a day exceeds 300000 tons. With a probability of 0.98, your answer should differ from the true value by no more than 0.03. Use a Normal approximation to determine the size of your Monte Carlo simulation.

Use Example 5.9 from the book to sample from the Poisson distribution and Example 5.11 to sample from the Gamma distribution.

b) Based on the study in part (a), estimate the total weight, X, of all the cargo that is unloaded at the port in a day.

c) Estimate Std(X) and comment on the accuracy of your estimator of X.

Submission

Submit your Matlab source code and a short report that describes the Monte Carlo study and answers the questions in parts (a), (b), and (c) via ODTUClass before the deadline. Please use fprintf to display the "Estimated probability", "Expected weight", "Standard deviation" and **provide a screenshot of these results in your report**. Your report can be a Word/Latex pdf document. Late submission is allowed with 20 points per day late submission penalty.