Problem set -2

Q1

In a sport hall there are 20 arrival gates and 20 auto-ticket-service places. Assume the arrivals follow a homogeneous Poisson process in each gate and for half of the gates the arrival rate is 3/hour and for the other half of gates it is 6/hour. The service time in the ticket service places are uniformly distributed. Half of them have between 12 and 18 minutes and the other half between 6 and 12 distributed service time.

The idea here is to simplify the complex problem of having 20 arrival gates and 20 servers to an achievable solution.

A) Try to use the idea of mixture/compound probability distribution to simplify the arrivals to the sport hall. You need to show that the result of such mixture is a certain distribution.

B) Try to use the idea of mixture/compound probability distribution to simplify the services in the sport hall. You need to show the result of such mixture is a certain distribution.

C) Use the results of A) and B) and modify the simple (M/U/1) code of ps2q1.m (please find it in the assignment material).

D) Using C) estimate for 100 and 1000 batches if T=8 hours:

- Average and variance of the time a customer spends in the sport hall,

- Average and variance of the amount of overtime put in by the servers,

- Average and variance of the number of departed persons.

Q2

For a queuing system, we need to generate an arrival rate which has Poisson random characteristic. Generate such arrival events when their total number is 1000 with an average of 10 arrival per time unit. For those 1000 events calculate standard deviation, mean, maximum, and minimum vales of number of arrivals per time unit.

Then choose 100 events of the 1000 events where any number of event (i.e. 1-1000 events) has the same probability to be chosen.

Finally find the distribution of the 100 events which were chosen from the last part. Comment/argue your result.

Q3

Assume we ask students of our course to stand randomly in a position in a classroom where their presence is according to a Poisson random process. The class has a size of 10 by 10 square meter and 39 students are registered in the course. Simulate the situation by plotting the positions of students in the class.