Assignment (15%)

Instructions:

1. This is an assignment done in groups of 3 or 4. Submit your group members' name (3 or 4 members in a group) to your respective tutor.

2. The date for the submission and demo is on **Monday of Week 13**. Please hand in the FreeMat code in CD together with the hardcopy of the report. Label your CD with the names of your group members and provide an e-mail address for contact purposes. All the group members' MUST attend the demo.

3. For the report, write down the detail of your simulation, construct the diagram such as flow-chart for each simulation and provide all outputs, table(service time, inter-arrival time and simulation) and results (evaluation results).

4. Creativity and extra effort will grant higher marks.

5. Plagiarism is not accepted under any circumstances. Zero marks will be given for any form of plagiarism such as copying from senior's work.

Queue simulator for service counters

Create a simulator for customer arrivals at any service provider. Choose a service provider such as bank, post office, telecommucation, etc. The simulation system should be able to simulate a queuing system **at most for three different types** of services. Different types of services will be served by different counters. Each service type should have **at least two serving counters**. For example services provided by a bank:

Service Type	Details	Counter
1	Deposit services, wire transfer services and etc	1,2,3
2	New Account opening, ATM card replacement and etc	4,5
3	Investment and loan consultancy	6,7

Firstly display the above table at the beginning of the simulation. Secondly, generate and display the table of the service type, service time and inter-arrival time.

Service type	1	2	3
Probability			
CDF			
Range			

Service Time for service type 1				……
Probability				……
CDF				
Range				

Service Time for service type 2				……
Probability				……
CDF				
Range				

Service Time for service type 3				……
Probability				……
CDF				
Range				

Inter-arrival Time			……..
Probability			……..
CDF			
Range			

Before the simulation starts, user should be able to prefix/select the counters that are in operation and counters that are not in operation. During the simulation more counters should be opened if there is a need (Set the conditions for this). For example, when there are too many customers in queue, there is a need for specific type of services and so on.

For generation of random numbers for the types of services, service time and inter-arrival time, you can consider ***rand*** function from FreeMat, linear congruential generators or other generators. User should be able to choose the type of random number generator to be used before the simulation. Use ***rand*** function to generate the seed number for the different generators. Adjust the range of random numbers so that they are within the appropriate range. For further details please refer to **Chapter 4**. On top of these,

a) user should be able to select the number of customers,
b) exhibit the message for the counter operating status, arrival, departure of the customers and so on from time to time. For example:

Counter 1 and Counter 3 are in operation.

Arrival of first customer at minute 0 and the queue number is 1001

Arrival of second customer at minute 2 and queue at the counter 2001

Departure of first customer at minute 4.

Service for second customer started at minute 2.

Counter 2 started operation at minute 3.

After the simulation, display the table of the simulation as the following example:

n	RN for Inter-arrival time	Inter-arrival time	Arrival time	RNs for the service type	Type of services	Queue number
1	-					1001
2						2001
3						1002
4						1003
5						2002
6						3001

Service type 1:

Queue number	Counter number	RN for service time	Service time	Time service begins	Time service ends	Waiting time	Time spends in the system
1001	1						
1003	2						
1002	1						

Service type 2:

Queue number	Counter number	RN for service time	Service time	Time service begins	Time service ends	Waiting time	Time spends in the system
2001	3						
2002	4						

Service type 3:

Queue number	Counter number	RN for service time	Service time	Time service begins	Time service ends	Waiting time	Time spends in the system
3001	5						

Then evaluate the results of the simulation, for example average inter-arrival time, average waiting time for each service type, average time spent for each service type, probability that a customer has to wait in the queue for each service type, and average service time each for each service type (refer to the example in the notes).