

SIMULATION MODELING

TUTORIAL SHEET – 2

Q1. A bank has one drive-in teller and room for one additional customer to wait. Customers arriving when the queue is full, park and go inside the bank to transact business. The time between-arrivals and service-time distributions are given below.

Time between Arrivals (Minutes)		Service Time (Minutes)	
	Probability		Probability
0	0.09	1	0.20
1	0.17	2	0.40
2	0.27	3	0.28
3	0.20	4	0.12
4	0.15		
5	0.12		

Simulate the operation of the drive-in teller for 10 new customers. The first of the 10 new customers arrives at a time determined at random. Start the simulation with one customer being served, leaving at time 3, and one in the queue. How many customers went into the bank to transact business?

Q2. A baker is trying to determine how many dozens of bagels to bake each day. The probability distribution of the number of bagel customers is as follows:

Number of Customers/Day	8	10	12	14
Probability	0.35	0.30	0.25	0.10

Customers order 1, 2, 3, or 4 dozen bagels according to the following probability distribution.

Number of Dozen Ordered/Customer	1	2	3	4
Probability	0.4	0.3	0.2	0.1

Bagels sell for \$5.40 per dozen. They cost \$3.80 per dozen to make. All bagels not sold at the end of the day are sold at half-price to a local grocery store. Based on 5 days of simulation, how many dozen (to the nearest 10 dozen) bagels should be baked each day?

Q3. A small grocery store has only one checkout counter. Customers arrive at this checkout counter at random from 1 to 10 minutes apart has the same probability of occurrence. The service times vary from 1 to 6 minutes as –

Service Time	1	2	3	4	5	6
Probability	.10	.20	.30	.25	.10	.05

Develop Simulation table for 10 Customers.

Q4. In above question (Q3.), let the service distribution be changed to the following:

Service Time	1	2	3	4	5	6
Probability	.05	.10	.20	.30	.25	.10

Develop the simulation table and the analysis for 10 customers.

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Q5. Students arrive at a single cashier bookstall at a random from 1 to 8 minutes apart. Each possible value of IAT has same probability of occurrence. The service time has the following probability distribution.

Service time(mts)	1	2	3	4	5
Probability	0.05	0.1	0.2	0.4	0.25

Simulate the stall for 10 students using the following random numbers for IAT and ST, random numbers given--

IAT=(231,468,154,922,385,643,796,564,615)

ST=(74,32,56,12,29,63,95,77,43,17)

Q6. Generate 10 random numbers using Mid-Square Random number generation method—

(a) 2061 (b) 4789

Q7. Generate 10 random numbers using Mixed Congruential Random number generation method— $r_{n+1} = (21r_0 + 53) \bmod 100$

Q8. Use Multiplicative congruential method to generate sequence of four 3-digit random numbers. Let $r_0=117$, $a=3$, $m=1000$.

Q9. Use Linear congruential method to generate 5 random numbers. Given that-----

i) Initial value = 27 ii) Multiplier = 17 iii) Increment = 43 and Modulus = 10

Q10. Generate a sequence of 15 random numbers for which seed is 342, constant multiplier is 20, increment is 45 and modulus is 30.