The waiting times for the patients were as follows:

Patient No.	Arrival	Service Starts	Waiting (Minutes)
1	8.00	8.00	0
2	8.30	9.00	30
3	9.00	9.15	15
4	9.30	10.00	30
5	10.00	10.45	45
6	10.30	11.30	60
7	11.00	1l.45	45
8	11.30	12.30	60
		Total	285

The average waiting time of a patient was = 35.625 minutes.

Illustration 4

A bakery chain delivers cakes to one of its retail stores each day. The number of cakes delivered each day is not constant but has the following distribution:-

Cakes delivered per day	*Probability*
10	*0.05*
11	*0.10*
12	*0.15*
13	*0.35*
14	*0.20*
15	*0.10*
16	*0.05*

The number of customers desiring cakes each day has the distribution:

No. of customers	*Probability*
5	*0.10*
6	*0.15*
7	*0.20*
8	*0.40*
9	*0.10*
10	*0.05*

Finally, the probability that a customer in need of cakes wants 1, 2, or 3 cakes is described by

Cakes to a customer	*Probability*
1	*0.40*
2	*0.40*
3	*0.20*

Estimate by Monte Carlo methods the average number of cakes left over per day and the average number of sales per day owing to lack of cakes. Assume that left over cakes are given away at the end of each day.

Solution

The first cumulative probability distribution is derived below:

Cumulative probability distribution of cakes delivered per day

Cakes per day	Probability	Cumulative Probability	Ten random nos. fitted in
10	.05	0.05	.0153(9)
11	.10	0.15	.1342(6)
12	.15	0.30	.2291(4)
13	.35	0.65	.5878(2),.4391(5),.5210(7),.3411(8)
14	.20	0.85	.8136(1),.7923(10).
15	.10	0.95	
16	.05	1.00	.9655(3)

Thus, the cakes delivered in each of the 10 days are: 14, 13, 16, 12, 13, 1l, 13, 13, 10, 14.

Likewise the no. of customers per day are derived below from the cumulative probability distribution.

No. of customers	Cumulative probability	Ten random nos. fitting in
5	0.10	.0906(9)
6	0.25	.2416(4),.1934(10)
7	0.45	.3501(l),.3396(3),.2587(5),.3072(6)
8	0.85	.5054(2)
9	0.95	.8511(7), .8698(8)
10	1.00	

Thus the number of customers for the ten days are 7, 8, 7, 6, 7, 7, 9, 9, 5, 6, and the total no. of customers = 71.

Thus cakes delivered per day and the no. of customers per day are laid out below.

	Days									
	1	2	3	4	5	6	7	8	9	10
No. of Customers desiring cake on nth Day	7	8	7	6	7	7	9	9	5	6
	1									
	2									
	3									
No. of cakes desired by each customer	3									
	2									
	1									
	2									
No. of cakes wanted	14									
No. of cakes delivered	14	13	16	12	13	11	13	13	10	14
Lift overs	NIL									
Shortage	NIL									

This table has to be filled in by selecting no. of cakes demanded by each customer from the third cumulative distribution derived below. In the first day, there are seven customers. Thus 7 random nos. have been fitted in the cumulative probability distribution below. These, in turn, have been put under day 1 of the above table. The student may fill in the remaining columns himself, as an exercise.

Cumulative probability distribution of the no. of cakes wanted by the customers.

(7 random nos. fitted in below give the entries under day of 1 for the above table.)

No. of Cakes	Cumulative probability	7 random numbers fitted in for day 1
1	0.40	.23(1), .00(6)
2	0.80	.49(2), .61(5), .48(7)
3	1.00	.82(3), .84(4)

Thus the no. of cakes wanted by the 7 customers in the first day are 1, 2, 3, 3, 2, 1, 2. These are entered under day 1. Left-overs and shortages are also computed which may be done by student for the remaining columns.

Illustration 5

A Company trading in motor vehicle spares wishes to determine the level of stock it should carry for the item in its range. Demand is not certain and replenishment of stock takes 3 days. For one item X, the following information is obtained.