

SIMULATION

Question 1

What are the steps involved in carrying out Monte Carlo simulation model? (4 Marks)(Nov., 2010)

Answer

Steps involved in Monte Carlo simulation are:

- (i) To select the measure of effectiveness of the problem, that is, what element is used to measure success in improving the system modeled. This is the element one wants to maximize or minimize.
- (ii) Identifying the variables which influence the measure of effectiveness significantly.
- (iii) Determining the proper cumulative probability distribution.
- (iv) To get a set of random numbers.
- (v) Consideration of each random number as a decimal value of the cumulative probability distribution. With the decimal, enter the cumulative distribution plot from the vertical axis, Project this point horizontally, until it intersects cumulative probability distribution curve.
- (vi) Recording the value generated in step(v) into the formula derived from the chose measures of effectiveness. Solve and record the value.
- (vii) Repeating steps (V) and (VI) until sample is large enough for the satisfaction of the decision maker.

Question 2

ABC Cooperative Bank receives and disburses different amount of cash in each month. The bank has an opening cash Balance of ₹ 15 crores in the first month. Pattern of receipts and disbursements from past data is as follows: (7 Marks)(May, 2010)

Monthly Cash receipts		Monthly Cash disbursements (Rs crores)	
₹ in Crores	Probability	₹ in Crores	P Probability
30	0.20	33	0.15

42	0.40	60	0.20
36	0.25	39	0.40
99	0.15	57	0.25

Simulate the cash position over a period of 12 months.

Required:

- Calculate probability that the ABC Cooperative Bank will fall short in payments.
- Calculate average monthly shortfall.
- If ABC bank can get an overdraft facility of ₹ 45 crores from other Nationalized banks.

What is the probability that they will fall short in monthly payments?

Use the following sequence (rowwise) of paired random numbers.

1778 4316 7435 3123 7244 4692 5158 6808 9358 5478 9654 0977

Answer

Monthly Cash receipts (Rs crores)				Monthly Cash disbursements (Rs crores)			
Cash	Probability	Cumulative	R.N.	Cash	Probability	Cumulative	R.N.
30	0.20	0.20	00-19	33	0.15	0.15	00-14
42	0.40	0.60	20-59	60	0.20	0.35	15-34
36	0.25	0.85	60-84	39	0.40	0.75	35-74
99	0.15	1.00	85-99	57	0.25	1.00	75-99

	Opening	Receipt			Payment		Closing
Months	(Rs in Crores)	Random Number.	(Rs in Crores)	Total	Random Number.	(Rs in Crores)	(Rs in Crores)
1	15	17	30	45	78	57	-12
2	-12	43	42	30	16	60	-30
3	-30	74	36	06	25	39	-33
4	-33	31	42	09	23	60	-51
5	-51	72	36	-15	44	39	-54
6	-54	46	42	-12	92	57	-69
7	-69	51	42	-27	58	39	-66
8	-66	68	36	-30	08	33	-63
9	-63	93	99	36	58	39	-3
10	-3	54	42	39	78	57	-18

11	-18	96	99	81	54	39	42
12	42	09	30	72	77	57	15

- (i) In 12 months, the bank falls short of cash in 10 months to meet payment.
Thus, probability of shortfall = $10/12 = 0.83$
- (ii) Total short fall of ₹ 399 crores over 10 months
Average monthly shortfall during 10 months = Rs 39.9 crores
- (iii) With an overdraft facility of ₹ 45 crores is available, there will be a shortfall in 5 months (4,5,6,7,8).. Therefore, probability is = $5/12 = 0.42$

Question 3

A car rental agency has collected the following data on the demand for five-seater vehicles over the past 50 days.

Daily Demand	4	5	6	7	8
No. of Days	4	10	16	14	6

The agency has only 6 cars currently.

- (i) Use the following 5 random numbers to generate 5 days of demand for the rental agency
Random Nos 15, 48, 71, 56, 90
- (ii) What is the average number of cars rented per day for the 5 days ?
- (iii) How many rentals will be lost over the 5 days? (5 Marks)(May, 2011)

Answer

Daily demand	Days	Probability	Cumulative probability	Random No.	Day	Demand	Rented	Rental lost
4	4	0.08	0.08	00.07	1	5	5	
5	10	0.20	0.28	08-27	2	6	6	
6	16	0.32	0.60	28-59	3	7	6	1
7	14	0.28	0.88	60-87	4	6	6	
8	<u>6</u>	<u>0.12</u>	1.00	88-99	5	8	<u>6</u>	<u>2</u>
	<u>50</u>	<u>1.00</u>					<u>29</u>	<u>3</u>

$$\text{Average no. of cars rented} = \frac{29}{5} = 5.8$$

$$\text{Rental lost} = 3$$