Simulation

Simulation is a method of solving decision making problem by designing, constructing and manupulating a model of real system. Simulation means to conduct an experiment.

Def^n: OT is a quantitative technique which uses a computerized symbolic model in order to represent actual decision making under uncertainity for det alternative course of action based on facts and assumptions.

OT normally involves a large no. of computation, whenever mathematical methods for getting an analytical solution does not exist. Simulation enable us to obtain a numerical sol^n to the problem.

Advantage :

1) OT is a straight forward & flexible technique.
2) OT is only method sometime available
3) Does not interfere with real world system, because with simulation experiments are done with models and not with system itself.
4) Once a model has been constructed it can be used over and over to analyze all kind of different situations again and again.

Drawbacks

1) OT is a long and complicated process to develop a model.
2) Does not generate optimal solution to problem unlike other quantitative technique.
3) OT is a trial and error approach that may produce different sol^n in repeated runs.
4) For complex problems, simulation is, by no means a cheap method of analysis. On a

Montecarlo simulation technique is used for solving the problems this is the method of random sampling which uses random numbers which are generated using the programs called pseudo random numbers.

Prob: A dentist schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time needed to complete the work.

Category	Time required (mins)	Probability of category
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival times, starting at 8 A.M. Use the following random numbers for handling the above problem: 40, 82, 11, 34, 25, 66, 17 and 79.

Soln:

The time taken by the dentist to treat the eight patients arriving in four hours at the clinic is calculated in the table below:

Table

Category	Time (minutes)	Probability	Cum. Probability	Random no. interval	Random No. fitted (Patient No.)
Filling	45	0.40	0.40	00 - 39	11(3), 34(4), 25(5), 17(1)
Crown	60	0.15	0.55	40 - 54	40(1)
Cleaning	15	0.15	0.70	55 - 69	66(6)
Extraction	45	0.10	0.80	70 - 79	79(8)
Checkup	15	0.20	1.00	80 - 99	82(2)

Thus the times take by the dentist to treat the eight patients are 60, 15, 45, 45, 45, 15, 45 & 45 min respectively.

Let us simulate the dentistis clinic (for eight patients) starting at 8 A.M.

Patient No.	Arrival time	Dentist's treatment Start	End	Waiting time on the part of the patient	Idle time for the dentist
1	8.00	8.00	9.00	—	—
2	8.30	9.00	9.15	30 mins	—
3	9.00	9.15	10.00	15 mins	—
4	9.30	10.00	10.45	30 mins	—
5	10.00	10.45	11.30	45 mins	—
6	10.30	11.30	11.45	60 mins	—
7	11.00	11.45	12.30	45 mins	—
8	11.30	12.30	13.15	60 mins.	—

∴ Average waiting time for the patients.

$$= \frac{1}{8}(30 + 15 + 30 + 45 + 60 + 45 + 60)$$

$$= \frac{285}{8} = 35.625 \text{ mins.}$$

∴ Average idleness of the dentist = Nil.