Total number of printed pages – 10

MCA

PMC 5905

Fifth Semester Examination – 2008

QUANTITATIVE TECHNIQUES – II

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (i) How do you differentiate between attribute and activity of a system? Give example of one attribute and one activity of a traffic system.

P.T.O.

(ii) Differentiate between closed and open system.

(iii) What do you mean by analytical and numerical models ? Are they static or dynamic in nature ?

(iv) Explain block-building principle in modeling.

(v) Explain congruence random number generator. What type of problems you will encounter in this generator ?

(vi) What do you mean by inter-arrival time and mean arrival rate in a queuing system ? In which way they are related ?

(vii) Explain ASSIGN block in GPSS.

(viii) What are the different operations used in GPSS programming ?

(ix) What do you mean by autocorrelated observations ? Give one example.

(x) Explain one method for elimination of transients in a sequence of observations.

2 (a) Discuss different types of models of a system with their characteristics. 5

(b) Name three principal entities, attributes and activities to be considered if you were to simulate the operation of

(a) petrol filling station

(b) a coffee house. 5

3. (a) Draw the flow chart of the process of simulation. Explain briefly the important functions involved. 5

(b) Find the correct value of the constant A that makes the following equation in y, a probability density function. Derive formula for generating random numbers having this distribution and compute first five values.

$y = A \sin x$ if $0 \leq x \leq \pi/2$

$= 0$ otherwise 5

4 (a) Describe inverse transformation method for generating random numbers. Find five random numbers corresponding to the fallowing probability function using inverse transformation method

$$f(x) = a(1 - x) \quad \text{if } 0 \le x \le \pi/2$$
$$= 0 \quad \text{otherwise}$$ 5

(b) Describe Monte Carlo technique to evaluate the integral

$$\int_a^b f(x)dx$$ 5

5. (a) The occurrence of rain is dependent upon whether it rained on the previous day. If it rained on the previous day, the rain distribution is given by : 5

Event	No rain	1 cm rain	2 cm rain	3 cm rain	4cm rain	5cm rain
Probability	0.50	0.25	0.15	0.05	0.03	0.02

If it did not rain the previous day, the rain distribution is given by :

Event rain	No rain	1 cm rain	2 cm rain	3 cm rain
Probability	0.75	0.15	0.06	0.04

Simulate the city's weather for 10 days and determine by simulation the total days without rain as well as the total rainfall during the period. Use the following random numbers :

67 63 39 55 29 78 70 06 78 76

(b) A company trading in motor vehicle spares wishes to determine the level of stock it should carry for the items in its range. The demand is not certain and there is a lead time for the stock replenishment. For one item X, the following information is obtained : 5

Demand (Units per day)	: 3	4	5	6	7
Probability	: 0.1	0.2	0.3	0.3	0.1

Carrying cost per unit per day = 20 paise

Ordering cost per order = Rs5/-

Lead time for replenishment = 3 days

Stock in hand in the beginning of the simulation exercise was 20 units. You are required to carry out a simulation run over a period of 10 days with the objective of evaluating the following inventory rule :

Order 15 units when present inventory plus any outstanding order falls below 15 units. Use the following random numbers: 0, 9, 1, 1, 5, 1, 8, 6, 3, 5

6. (a) The arrival of customers and service time of customers are having the following distributions. Simulate this queuing system for 10 periods by using the following random numbers and calculate the mean waiting time and mean queue length.

Inter-arrival time (minutes)	Probability	Service time (minutes)	Probability
5	0.15	7	0.10
6	0.35	8	0.35
7	0.40	9	0.45
8	0.10	10	0.10

Random numbers for arrival : 36, 60, 82, 14, 14, 62, 62, 10, 55, 14

Random numbers for services : 34, 35, 31, 62, 48, 73, 88, 70, 19, 40. 5

(b) A bakery keeps stock of a popular brand of cake. Daily demand based on the past experience is given below :

Daily demand :	0	10	20	30	40	50
Probability :	0.01	0.10	0.23	0.45	0.17	0.04

Considering the following sequence of random numbers 38, 72, 17, 48, 53, 78, 11, 16, 65, 07 simulate the demand for the next 10 days. 5

7. (a) What are the forms of the following blocks used in GPSS ? What are the uses of these blocks in simulation process ? Also state the different fields they use :

TABULATE, GENERATE, DEPART. 5

(b) Write a GPSS program for the following problem :

Workers come to a supply store at the rate of one every 5 ± .2 minutes. Their requisitions are processed by one or two clerks who take 8 ± 4 minutes for each requisitions. The requisitions are then passed to a single store keeper who fills them one at time, taking 4 ± 3 minutes for

each request. Simulate the queue of workers and measures the distribution of time taken for 1000 requisitions to be filled. 5

8. (a) What is the necessity of reducing the variance in a simulation experiment ? Describe the antithetic sampling as a variance reduction technique. 5

(b) A sequence of 500 observations were made and found to be serially correlated. The autocorrelation coefficients were estimated as $r_1 = 0.31$, $r_2 = 0.22$ and $r_3 = 012$. others are not significantly different from zero The mean and variance of 500 samples were found to be 22.5 and 980 respectively. Calculate the minimum sample size to assume that the estimate lies within ± 2 units of the true mean with 95% degree of confidence. (Given $y1 - \alpha/2 = 1.96$). 5
