FIFTH SEMESTER EXAMINATION-2005

QUANTITATIVE TECHNIQUES -II

Full Marks – 70

Time : 3 Hours

The figures in the right hand margin indicate full marks for the questions.

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

1. Answer the following in a sentence or two : 2×10

(i) The time between arrivals is distributed equally likely between 1 to 4 minutes. The random number for inter-arrival time is generated for 5 customers as, 5, 75, 66, 33, 22. ***Find the inter-arrival probability distribution and hence arrival time of customers.***

P.T.O.

(ii) Arrival time of customers is given for a simulation starting at 0 time. ***Find the inter-arrival time and arrival rate per hour.***

Customer no.	Arrival time (second)
1	2
2	6
3	7
4	10
5	15

(iii) If a m/c needs to replace 45 bearings with a repair person who takes 15 minutes to replace a bearing with a charge of 2 JD per minute. ***What will be total cost for replacing the bearings for the given data.***

Cost/bearing = 2 JD

Down time cost= 60 JD per hour

Delay time = 2 hour 10 minutes

(iv) Draw the ***flow diagram*** for the departure event of customer in a single server queue.

(v) What is a model ? How does a discrete event model differs from a continuous model?

(vi) What are the advantages of using a general purpose language for simulation programming?

(vii) Out of 20 customers, 7 customers do not have to wait for their service. What is the probability of customers who wait?

(viii) In a (M,N) inventory, if there are 3 units left in the inventory at the end of a cycle, ***how many*** *units* to be ordered before starting the new cycle?

(ix) Find the service time and average service time for customers with given service time distribution and random digits (95,21,51,92,89)

Service time	Probability
3	0.35
4	0.25
5	0.20
6	0.20

(x) Given: cost/newspaper=300 fills

selling price/ newspaper=600 fills

scrap price/ newspaper=25 fills

If a seller purchases 250 newspapers on Monday andTuesday. However, he could have sold 300 each day. *Calculate his total profit.*

2. For a newspaper seller who buys 200 newspapers per day following data is available and for 5 days simulation is performed based on following data.

(a) Type of news day and its probability: good→0.35, fair→0.45, poor→0.20

(b) Distribution of newspaper demand

Demand	Good day	Fair day	Poor day
120	0.03	0.10	0.44
150	0.20	0.58	0.38
180	0.55	0.28	0.18
250	0.22	0.04	0.00

(c) Random digits for demand: 240, 060, 045,254,284

Random digits for news day: 97,77,49,45,43

Sketch the simulation table and calculate the seller's total profit. 10

3. (a) Draw the ***flow chart*** of invoking different modules(subroutines) in Discrete Event Simulation

(b) For the following data *compute the average queue length* if the simulation time is completed at 8.6 minutes and total number of customers in the system is 5.

Number of Customers	0	1	2	3	4	5
Time (T_i)	3.2	2.3	1.7	1.4	0	0

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4 Consider an (12,4) inventory problem with a random lead time. Find *the average ending inventory and number of shortage days* for a simulation of 2 cycles. For the data given below:

Demand Distribution		Lead time distribution	
Daily Demand	Demand probability	Lead time (days)	Probability
0	0.19	1	0.6
1	0.25	2	0.3
2	0.35	3	0.1
3	0.21		

(a) Simulation started with 2 units in hand. 10 units ordered with a lead time of 3 days

(b) Orders are always made at the end of day and received in the beginning of the day

(c) The random digits for demands are: 24,81,10,50, 46, 85,89,25 and that for lead time are: 1, 5

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5. For a single server FIFO queue model following data is available

(a) Inter arrival time is distributed equally likely between 1 to 5 minutes

(b) Service time is distributed equally likely between 1 to 8 minutes

(c) Random digits for inter arrival time :

__, 913, 727, 015, 948

Random digits for service time:

840, 011,743,533,177

(d) Simulation starts at 0 and first customer is assumed to arrive at clock time 0

Sketch the simulation table and hence compute

(i) average waiting time

(ii) probability that a customer has to wait

(iii) Percentage of idle time of server

(iv) average service time 10

6. Consider a m/c with 3 bearings. When any of the bearing fails m/c stops and a repair-person is called (having random delay).

(a)
Downtime cost :300 JD per hour
Repair person : 2 JD per minute charge
Bearing cost: 12 JD each
Time taken by repair person to
replace one bearing: 5 minutes
replace two bearings: 7 minutes
replace three bearings: 10 minutes

(b) Bearing Life Distribution

Bearing life (hrs.)	Probability
1000	0.20
1100	0.15
1200	0.35
1300	0.15
1400	0.10
1500	0.05

(c) Delay time Distribution

Delay time(min.)	Probability
5	0.5
10	0.3
15	0.2

(d) Random digits for life of
1st bearing: 67,08,49,84,44
2nd bearing: 70,43,86,93
3rd Bearing: 76 ,65 ,61 ,96
Random digits for delay:
1st bearing: 2,3,1,7,8
2nd bearing: 0,7,3,1
3rd bearing: 0,7,2,1

(e) Delay for three replacement case is 5,7,5,1,4 and additional random numbers for life of bearing are 81 and 65.

Evaluate whether single replacement as and when a bearing fails or replacement of all the three bearings when one bearing fails is profitable.

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7 (a) Draw the *flow chart* for system simulation steps.

(b) or the following data ***compute the average queue length*** if the simulation time is completed at 8.6 minutes and total number of customers in the system is 5.

Number of Customers	0	1	2	3	4	5
Time (T)	3.2	2.3	1.7	1.4	0	0

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8 Write notes on :

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(a) Factors for selecting a discrete system simulation Language

(b) GPSS

(c) Evaluation of Simulation Experiments

(d) Role of random numbers in simulation.

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