Code No: R05311302 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2008
OPERATIONS RESEARCH
(Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is duality principle? Explain.
   (b) Use the duality principle to solve the following L.P.P and find the solution of primal from the dual solution.
   Minimize $z = 4x_1 + 2x_2 + 3x_3$ subjected to: $x_1 + 4x_3 \geq 5$
   $2x_1 + 3x_2 + x_3 \geq 4$
   and $x_1, x_2, x_3 \geq 0$. [4+12]

2. A salesman has to visit five cities A, B, C, D and E. The distance (in hundred kilometers) between the cities are given in table 2.

From City \ To City	A	B	C	D	E
A	–	1	6	8	4
B	7	–	8	5	6
C	6	8	–	9	7
D	8	5	9	–	8
E	4	6	7	8	–

table 2

If the salesman starts form city A and has to come back to city A after travelling to all the cities. Which route should he select so that the total distance traveled is minimum. [16]

3. The following failure rates have been observed for a certain type of light bulbs.

End of week :	1	2	3	4	5	6	7	8
Probability of failure to date :	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00

The cost of replacing an individual bulb is Rs. 2.25. The decision is made to replace all bulbs simultaneously at fixed intervals, and also to replace individual bulbs as they fail in service. If the cost of group replacement is 60 paise per bulb and the total number of bulbs is 1000, what is the best interval between group replacement? [16]

4. (a) Define saddle point. Explain pure and mixed strategies.
   (b) Find out whether there is any saddle point in the following problem : Also find the value of the game. [6+10]

$$\begin{array}{c} \\ \text{Player A} \end{array} \begin{array}{c} \text{Player B} \\ \begin{bmatrix} -3 & 1 \\ 3 & -1 \end{bmatrix} \end{array}$$

5. At present a servicing department provides answers through one channel, which on average can deal with 24 enquiries/hour at a cost of Rs.3 per enquiry. Increasingly the customers are complaining that they have to wait for a long time and the department is considering alternative arrangements. There is either a two-channel system costing Rs.100/hour and service rate of 15/hour in each, or a three-channel system costing Rs.125/hour and service rate of 10/hour in each. Customers arrive at the rate of 20/hour. Your are required to calculate
   (a) The average time that a customer is in the system under the present arrangement.
   (b) The extra charges per enquiry that would need to be made to recover the extra cost of each of the two arrangements proposed. [16]

6. (a) Discuss about a deterministic inventory model with shortages.
   (b) A product 'X' is purchased by a company from outside suppliers. The consumption is 10,000 units per year. The cost of the item is Rs.5 per unit and the ordering cost is estimated to be Rs.100 per order. The cost of carrying inventory is 25%. If the consumption rate is uniform, determine the economic purchasing quantity. [6+10]

7. Use DPP method to
   Minimize $Z = x_2+3x_2+4x_3$.
   Subject to

$$\begin{aligned} 2x_1+4x_2+3x_3 &\geq 60, \\ 3x_1+2x_2+x_3 &\geq 60 \\ 2x_1+x_2+3x_3 &\geq 90 \text{ and} \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

   [16]

8. A firm has single channel service station with following arrival and service time probability distributions:

Arrivals (min)	Probability	Service Time (min)	Probability
1.0	0.35	1.0	0.20
2.0	0.25	1.5	0.35
3.0	0.20	2.0	0.25
4.0	0.12	2.5	0.15
5.0	0.08	3.0	0.05

   The customer's arrival at the service station is a random phenomenon and the time between the arrival varies from one minute to five minutes. The service time varies

from one minute to three minutes. The queuing process begins at 10.00 a.m. and proceeds for nearly 2 hours. An arrival goes to the service facility immediately, if it is free. Otherwise it will wait in a queue. The queue descipline is first-come first-served.
If the attendant's wages are Rs 8 per hour and the customer's waiting time costs Rs 9 per hour, then would it be an economical proposition to engage a second attendant? Answer on the basis of Monte Carlo simulation technique. [16]

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