Code No: **R42243**

R10

IV B.Tech II Semester Supplementary Examinations, July/Aug - 2015
OPERATIONS RESEARCH
(Automobile Engineering)

Time: 3 hours   **Max. Marks: 75**
Answer any FIVE Questions
All Questions carry equal marks
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1   Solve the following problem using duality:
     Subject to the constraints:
     $2x_1 + 4x_2 \geq 1$
     $x_1 + 2x_2 \geq 1$
     $2x_1 + x_2 \geq 1$
     $x_1 \geq 0; x_2 \geq 0$

2.a) Explain the following with respect to the transportation model"
          (i)   Basic feasible solution
          (ii)   Unbalanced transportation problem

   b) Four jobs 1, 2, 3 and 4 are to be processed on each of the five machines A, B, C, D and E in
       the order ABCDE, as shown in table given below. Find the total minimum elapsed time if
       no passing of hobs is permitted.

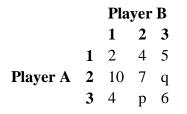| Machine Job	A	B	C	D	E
1	7	5	2	3	9
2	6	6	4	5	10
3	5	4	5	6	8
4	8	3	3	2	6

3   A machine is priced at Rs. 5000 and running costs are estimated at Rs. 800 for each of the
     first five years and increasing by Rs. 200 per year in the sixth and subsequent years. If the
     money is worth 10% per year, determine the year at which machine is replaced.

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4.a) Two players A and B match coins. If the coins match, A wins one unit of the value. If the coins do not match, then B wins one unit of the value. Determine the optimal strategies of the players and value of the game.

b) Find the range of values p and q, which will render (2,2) as a saddle point.

$$\begin{array}{c c c c c}
 & & \textbf{Player B} & & \\
 & & \textbf{1} & \textbf{2} & \textbf{3} \\
 & \textbf{1} & 2 & 4 & 5 \\
\textbf{Player A} & \textbf{2} & 10 & 7 & q \\
 & \textbf{3} & 4 & p & 6 \\
\end{array}$$

5 In a railway yard goods train arrive at a rate of 60 trains/day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 72 minutes. Calculate the following:
   a) The average number of trains in the queue
   b) The average number of trains in the system
   c) The probability that number of trains in the system exceeds 10

6 The annual demand for a product is 500 units. The cost of storage per unit per year is 10% of unit cost. The ordering cost is Rs. 180 for each order. The unit cost depends upon the quantity ordered. The range of quantity ordered and the unit cost price are as follows:

Range of quantity ordered	Unit cost (Rs)
$0 \le q > 500$	25.00
$500 \le q > 1500$	24.80
$1500 \le q > 3000$	24.60
$q \ge 3000$	24.40

7 Apply dynamic programming to solve the following LP problem
Maximize $f(x) = 5 x_1 + 10x_2$
Subject to the constraints:
   $10x_1 + 5x_2 \le 250$
   $4x_1 + 10x_2 \le 200$
   $2x_1 + 3x_2 \le 900$
   $x_1 \ge 0; x_2 \ge 0;$

8 Arrivals at a service station have been found to follow poisson process; the mean arrival rate is 6 units per hour. Simulate 3 hours of arrivals at the station.

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Set No.2

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Time: 3 hours   **Max. Marks: 75**
Answer any FIVE Questions
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1   Minimize $z = 2x_1 + 9x_2 + x_3$
     Subject to the constraints:
     $x_1 + 4x_2 + 2x_3 \geq 5$
     $3x_1 + x_2 + 2x_3 \geq 4$
     $x_1 \geq 0; x_2 \geq 0; x_3 \geq 0;$

2.a) Explain the different methods for obtaining the initial basic feasible solution.

  b) Five operators have to be assigned to five machines. The assignment costs are given in the table given below. Operator A cannot operate machine III and operator C cannot operate machine IV. Find the optimal assignment.

Machine Operator	I	II	III	IV	V
A	5	5	--	2	6
B	7	4	2	3	4
C	9	3	5	--	3
D	7	2	6	2	2
E	6	5	7	1	1

3   A truck has been purchased at a cost of Rs. 1,60,000. The value of the truck is depreciated in the first three years by Rs. 20,000 each year and Rs. 16,000 per year there after. If the maintenance and operating costs for the first three years are Rs.16,000, Rs.18,000 and Rs,20,000 in that order and increase by Rs,4,000 every year. Find the economic life of the truck. Assume the interest rate of 10%.

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4.a) Solve the game whose payoff matrix for the player A is given in table below:

Player B

		I	II
	I	2	4
Player A	II	2	3
	III	3	2
	IV	-2	6

b) Explain the rules to determine the saddle point of game.

5 Arrival rate of a telephone booth are according to poison distribution with an average time of 10 minutes between two consecutive arrivals. The length of a telephone call is assumed to be exponentially distributed with mean 4 minutes.
   a) Determine the probability that a person arriving at the booth will have to wait.
   b) Find the average waiting length
   c) Find the fraction of day that the phone will be in use.
   d) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least 4 minutes for the phone. Find the increase in flow of arrivals, which will justify a second booth.

6 The annual demand for a product is 64,000 units. The cost per order is Rs. 10 and the estimated cost of carrying one unit stock for a year is 20%. The normal price of the product is Rs. 10 per unit. However, the supplier offers a quantity discount of 2 % on order at least 1000 units a t a time and a discount of 5 % if the order is at least 5000 units. Suggest the most economical purchase quantity per order.

7 Apply dynamic programming to solve the following problem
   Maximize $f(x) = 3 x_1 + 5x_2$
   Subject to the constraints:
   $x_1 \leq 4$
   $x_2 \leq 6$
   $3x_1 + 2x_2 \leq 18$
   $x_1 \geq 0; x_2 \geq 0;$

8 A book store wishes to carry a book in stock. Demand is probabilistic and replenishment of stock is 2 days. If an order is placed on beginning of March 1, it will be delivered at the beginning of the day on march3. The probabilistic demand is given in the following table.

Daily demand (number of books)	0	1	2	3	4
Probability (p)	0.05	0.10	0.30	0.45	0.10

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