Code No: R31032 **R10** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, May - 2013

OPERATIONS RESEACH

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

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
   $x_1, x_2, x_3 \geq 0$.

2. (a) When do you say a solution to a transportation problem is degenerate?
   (b)A company has three plants X, Y, Z and each producing 50,100,150 units of a similar products. There are five ware houses W1, W2, W3, W4 and W5 having demand of 100, 70, 50, 40 and 40 units respectively. The cost of transporting the products from plants to warehouses is given in the following matrix.

	W1	W2	W3	W4	W5
X	20	28	32	55	70
Y	48	36	40	44	25
Z	35	55	22	45	48

   Determine the transportation schedule so that the cost is minimized.

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 1.25. 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 30 paise per bulb, what is the best interval between group replacements?

4. (a) Consider the following pay-off matrix and determine the optimal strategy.

A \ B	I	II	III
I	6	9	4
II	5	10	7
III	9	8	9

   (b)Write a note on zero-sum games.

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5. The mean rate of arrival of planes at an airport during the peak period is 20 hour, but the actual number of arrivals in any hour follows a Poisson distribution with the respective averages. When there is congestion, the planes are forced to fly over the field in the stack awaiting the landing of other planes that arrived earlier.
   (a) How many planes would be flying over the field in the stack on an average in good weather and in bad weather?
   (b) How long a plane would be in the stack and in the process of landing in good and in bad weather?
   (c) How much stack and landing time to allow so that priority to land out of order would have to be requested only one time in twenty?

6. (a) What are the reasons for stocking items in inventory?
   (b) A manufacturing company purchases 10000 parts of a machine for its annual requirements ordering one month usage at a time. Each part costs Rs. 30/-. The ordering cost per order is Rs. 25/- and the carrying charges are 25% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer, and how much would it save the company per year?

7. (a) Write a note on the application of dynamic programming.
   (b) Define the following terms in dynamic programming:
   (i) State (ii) State variable (iii) Immediate return (iv) Optimal return .

8. Define simulation. Explain about simulation languages.

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Code No: R31032 **R10** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, May - 2013

OPERATIONS RESEACH

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

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1. (a) What is an unbounded solution? Explain.
   (b) Use the graphical method to solve the following LP Problem

   Maximize $Z = 3x_1 + 4x_2$

   subject to the constraints

   $x_1 - x_2 = -1$

   $-x_1 + x_2 \leq 30$

   $x_1, x_2 \geq 0$.

2. (a) Briefly explain the Vogel's Approximation Method.
   (b) An oil corporation has got three refineries R1, R2, R3 and it has to send petrol to four different depot D1, D2, D3 and D4. The cost of supplying of one litre of petrol from each refinery to each depot is given below. The requirements of the depot and the available petrol at the refineries are also given. Find the minimum cost of shipping after obtaining the initial solution by Vogel's Approximation Method.

Depot (Rs in thousand)

Refineries	D_1	D_2	D_3	D_4	Availability
R_1	6	4	5	6	600
R_2	8	4	6	7	800
R_3	5	8	6	8	900
Requirements	700	800	300	500	2300

3. State the conditions under which the problem of processing of jobs through three machines has been solved. Describe the corresponding algorithm.
   Find the sequence that minimizes the total time required to complete the following tasks:

Task	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Machine *I*	9	8	7	4	3	8	7
Machine *II*	1	3	2	5	4	4	3
Machine *III*	5	7	5	11	6	6	12

4. (a) For the following pay-off matrix, determine the best strategies and the value of the game

Y

	j	k	l
p	60	50	40
q	70	70	40
r	80	60	75

X

   (b) Briefly explain the limitations of game theory.

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5. A company distributes its product by trucks loaded at its only loading station. Both company's trucks and contractor's trucks are used for this purpose. It was found out that on an average every five minutes on truck arrived and the average loading time was three minutes. 50% of the trucks belong to the contractor. Find out:
   (a) The probability that a truck has to wait.
   (b) The waiting time of truck that waits and
   (c) The excepted waiting time of contractor's trucks per day assuming a 24 hours shift.

6. (a) What are costs that are involved in carrying inventory? Explain them in detail.
   (b) A small firm producing automobile brake linings estimates the steel requirements for the next year's production at 6000 Kg. The cost of carrying steel in inventories works out to Rs 1 per Kg. Per month. The cost of ordering works out at Rs 100 per order. If the cost per kg of steel is Rs 100, find out the economic order quantity, the number of orders per year, and total cost incurred by the firm for one year.

7. (a) What are the situations warranting the use of dynamic programming?
   (b) Six units of capital is available to invest in four business ventures. The returns from each unit of investment in all the four ventures are given in the table below. Find how should the capital be allocated to business proposals in order to maximize profit using dynamic programming.

	Expected returns from Business proposals			
	Unit	A	B	C	D
Capital	0	0	0	0	0
	1	5	2	6	2
	2	6	4	7	3
	3	7	6	8	4
	4	8	8	8	5
	5	8	9	8	6
	6	8	10	8	6

8. Define simulation. Explain utility of simulation to solve inventory problems.

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Code No: R31032 **R10** **Set No: 3**

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OPERATIONS RESEACH

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

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1. (a) Describe the different methods of solving O.R. models.
   (b) Write the dual of the following primal problem.
   Minimize $Z = x_1 + 3x_2$ Subject to: $3x_1 + 4x_2 \geq 5$
   $x_1 + x_2 \geq 2$
   $x_1 + 2x_2 \geq 3$
   $x_1, x_2, x_3 \geq 0$

2. Obtain the VAM starting solution for the following transportation problem. And solve it.

Depots ↓	Customer 1	2	3	4	Supply
1	18	16	8	11	100
2	14	14	8	10	125
3	19	15	16	15	70
4	8	12	19	11	80
Demand	55	130	95	95	375

3. (a) Briefly explain what you mean by "individual and group replacement policy" in Replacement Analysis.
   (b)There is a special light bulb that never lasts longer than 2 weeks. There is a chance of 0.3 that a bulb will fail at the end of first week. There are 100 new bulbs initially. The cost for individual replacements is Rs.1.25 and the cost per bulb for group replacement is Re.0.50. Is it cheaper to replace all the bulbs,
   (i) Individually (ii) every week (iii) every second week.

4. (a) Briefly explain(i)pure strategy (ii)mixed strategy (iii)optimal strategy
   (b) Find the saddle point, optimum strategies and value of the game in the following pay off matrix

	Y				
	A	B	C	D	
I	-3	4	2	9	X
II	7	8	6	10	
III	6	2	4	-1	

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5. (a) Gives a brief description of the various types of queues.
   (b) In a color TV manufacturing plant, a loading unit takes exactly 10 minutes to load two TV sets fat a time into a wagon and again comes back to the position to load another set of TVs. If the arrival of TVs is a Poisson stream at an average of 2 TVs every 20 minutes calculate the average waiting time of 2 TV sets in a stationary state.

6. (a) A Company uses annually 48000 units of a raw material costing Rs. 1.20 / unit. Placing each order costs Rs. 45/-, carrying cost is 1.5 % /year of the average inventory. Find E.O.Q and Minimum cost.
   (b) Derive the equation for E.O.Q.
7. (a) Explain the concept of dynamic programming.
   (b)Consider loading a vessel with stock of three types of items. Each unit of item I has a weight w_i and a value r_i (r = 1,2,3).

i	w_i	r_i
1	1	30
2	3	80
3	2	65

   The maximum cargo weight W is 5. It is required to determine the most valuable cargo load without exceeding the maximum weight of the vessel. Use Dynamic Programming technique.

8. Discuss about various types of simulation models.

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Code No: R31032 **R10** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, May - 2013

OPERATIONS RESEACH

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Define Operations Research in at least three different ways.
   (b) Solve the following using graphical method

   maximize Z= 9x + 10y

   subject to $11x + 9y \leq 9900$

   $7x + 12y \leq 8400$

   $6x + 16y \leq 9600$ and

   $x \geq 0, y \geq 0$

2. Solve the following transportation problem.

Origins \ Destinations	D1	D2	D3	D4	D5	Availability
O_1	9	12	9	6	9	5
O_2	7	3	7	7	5	4
O_3	6	5	9	11	3	2
O_4	6	8	11	2	2	9
Requirements	4	4	6	2	4	20

3. A manufacturer finds from his records that the cost per year associated with the machine whose purchase price isRs 5000/- are as follows:

Year	1	2	3	4	5	6	7	8
Running cost in Rs.	1500	1600	1800	2100	2500	2900	3400	4000
Re-sale value in Rs.	3500	2500	1700	1200	800	500	500	500

   Determine age at which the machine should be replaced.

4. (a) Explain the following: (i) competitive games (ii) Two-person zero -sum game.
   (b) Solve the following game using dominance principle.

Player A \ Player B	1	2	3	4
I	19	6	7	5
II	7	3	14	6
III	12	8	18	4
IV	8	7	13	-1

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5. (a) State some of the important distributions of arrival intervals and service times.
(b) In a car gaurage A, if takes 15 minutes to wash one car. Cars arrive to the gaurage at an average rate of one every 25 minutes and arrival process is Poisson. In Car-gaurage B, it takes 25 minutes to wash one car and cars arrive to this shop at an average rate of one every 45 minutes, the arrival process being Poisson during steady state. Determine (i) at which gaurage you expect the bigger queue. (ii) at which gaurage you require more times waiting including the service time.

6. (a) An automobile spares company has an annual demand for 5000 spares. The cost of placing order is Rs. 250/- & inventory carrying cost is 30 %. The price / spare is Rs. 50/-. The Supplier offers 2 % discount if 1000 or more spares are purchased. What should be the ordering quantity?
(b) Explain briefly: i) Sit up Cost ii) Holding Cost iii) Lead time. Give examples.

7. (a) Discuss the relation between linear and dynamic programming.
(b) Solve the following problem by using dynamic programming:

Max. $Z= 2x_1 + 9\ x_2$
subject to $2x_1 + x_2 \leq 25$
$x_2 \leq 11$
$x_1, x_2 \geq 0.$

8. What is the importance of simulation and modeling? Explain utility of simulation to solve inventory problems.

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