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Printed Pages : 7 **TMA – 013**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9974 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) EXAMINATION, 2008-09

PRINCIPLES OF OPERATION RESEARCH

Time : 3 Hours] *[Total Marks : 100*

Note : (i) Attempt all the questions.

(ii) Graph papers will be provided on demand.

1 Attempt any **four** parts of the following : **5×4=20**

(a) A manufacturer produces three types of alloys *A, B* and *C* by mixing Copper, Zinc and Lead. For alloy *A* copper, zinc and lead are mixed in a ratio 1, 2, 3; for alloys *B* the ratio is 2, 3, 5 and for alloy *C* the ratio is 1, 3, 7. The availabilities of copper, zinc and lead are 20 kg, 40 kg and 50 kg respectively. If profits per unit of *A, B* and *C* are Rs. 10, Rs. 15 and Rs. 17. Formulate this instance as a LPP so as to maximize the profit.

(b) Solve the following problem graphically :

Maximize : $2x_1 + 3x_2$

Subject to

$$x_1 + 5x_2 \leq 20$$
$$2x_1 + 3x_2 \leq 30$$
$$\text{and } x_1, x_2 \geq 0$$

(c) Write briefly the simplex algorithm and solve the LPP given in 1(b) using Simplex-algorithm.

(d) Define the dual of a LPP. Prove that the dual of the dual of a LPP is the LPP itself.

(e) Describe two-phase simplex method to solve a LPP. Hence, solve

Maximize : $5x_1 - 4x_2 + 3x_3$

Subject to

$$2x_1 + x_2 - 6x_3 = 20$$
$$6x_1 + 5x_2 + 10x_3 \leq 76$$
$$8x_1 - 3x_2 + 6x_3 \leq 50$$

and $x_1, x_2, x_3 \geq 0$

(f) Solve the following LPP by Dual simplex method :

Maximize : $-(3x_1 + x_2)$

Subject to

$$x_1 + x_2 \geq 1$$
$$2x_1 + 3x_2 \geq 2$$
$$\text{and } x_1, x_2 \geq 0$$

2 Attempt any **two** parts of the following : **10×2=20**

(a) Formulate an assignment problem and describe the Hungarian algorithm to solve it. Hence solve the following assignment problem.

A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency and tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task is given in the matrix below :

	Men			
Task	M_1	M_2	M_3	M_4
T_1	18	26	17	11
T_2	13	28	14	26
T_3	38	19	18	15
T_4	19	26	24	10

How should the tasks be allocated to a man, so as to minimize the total time required to finished the tasks ?

(b) Formulate an integer linear programming problem and give a concise description of the branch and bounded algorithm to solve it. Hence solve

Maximize : $2x_1 + 5x_2$

Subject to

$$5x_1 + 3x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4$$

and x_1, x_2 are non-negative integers.

(c) Describe the revised simplex algorithm and using it solve the LPP given in Q.1(a).

3 Attempt any **two** parts of the following : **10×2=20**

(a) Formulate the facility location problem as a 0-1 integer linear programming problem.

(b) Six different items are being considered for shipment. The weight and value of each item is given in the following table :

Item	1	2	3	4	5	6
Weight	10	9	15	2	11	6
Value	5	2	7	4	1	6

Formulate this problem as 0-1 integer linear programming problem and solve it.

(c) A project consists of a series of tasks labelled *A, B, C, D, E, F, G, H, I* with the following relationships ($W < X, Y$ means X and Y can not start until W is completed; $X, Y < W$ means that W can not start until both X and Y are completed) with this notation, construct the network diagram having the following constraints :

$A < D,\ E;\ \ B, D < F;\ C < G;$

$B,\ G < H;\ \ F,\ G < I.$

Find also the minimum time of completion of the project when time (in days) of completion of each task is as follows :

Task	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Time	23	8	20	16	24	18	19	4	10

4 Attempt any **two** parts of the following : **10×2=20**

(a) Describe the optimal sequence algorithm for n-jobs and to machines. We have five jobs, each of which must go through the two machines *A* and *B* in the order *AB*. Processing times in hours are given in the table below :

Job (i)	1	2	3	4	5
Machine $A(A_i)$	5	1	9	3	10
Machine $B(B_i)$	2	6	7	8	4

Determine a sequence for the five jobs that will minimize the ellasped time.

(b) The demand for a particular item is 18000 units per year. The holding cost per unit is Rs. 1.20 per year and the cost of one procurement is Rs. 400, no shortages are allowed, and the replacement rate is instanteous. Determine :

(i) Optimal order quantity

(ii) Number of order per year

(iii) Time between orders, and

(iv) Total cost per year when the cost of one unit is Re. 1.00

(c) Discuss the various deterministic models for the inventory system. A company has a steady demand of a product of 40 items per month. The purchase cost is Rs. 6 per item and cost of ordering and procuring the material is Rs. 15 per occasion. If stock holding cost is 20% per annum, how frequently should the company replenish the stock ?

5 Attempt any **two** parts of the following : **10×2=20**

(a) State principle of optimality. Divide a positive quantity, C into n parts so as to maximize their product.

(b) Seven units of capital can be invested in four activities with return from each activity given in the following table. Find the allocation of capital to each activity that will maximize the total return (formulate the problem as a dynamic programming problem and solve it)

Q	$g^1(Q)$	$g^2(Q)$	$g^3(Q)$	$g^4(Q)$
0	0	0	0	0
1	2	3	2	1
2	4	5	3	3
3	6	7	4	5
4	7	9	5	6
5	8	10	5	7
6	9	11	5	8
7	9	12	5	8

(c) Discuss the probabilistic inventory model with instanteous demand no set up cost.
