Printed Pages : 8 **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, 2007-08

PRINCIPLES OF OPERATION RESEARCH

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

Note : *(1) Attempt all questions.*

(2) All questions carry equal marks.

(3) The choice of questions is internal as indicated in each question.

(4) Graph papers will be provided on demand.

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

(a) Formulate the following problem as a linear programming problem :

A firm manufactures two types of products A and B and sells them at a profit of Rs. 10 on type A and Rs. 16 on type B. Each product is processed on two machines G and H. Type A product requires two minutes of processing time on G and five minutes on H, type B product requires three minutes on G and four

minutes on H. The machine G is available for not more than 4 hours 20 minutes while machine H is available for 6 hours 40 minutes during any working day.

(b) Solve the following LPP by graphical method :

Maximize $Z = 2x_1 + 3x_2$

Subject to $x_1 + x_2 \leq 30$, $x_2 \geq 3$, $0 \leq x_2 \leq 12$,

$x_1 - x_2 \geq 0$ and $0 \leq x_1 \leq 20$.

(c) Find an optimal solution to the following LPP by computing all basic solutions and then finding one that maximizes the objective function

Maximize $Z = 2x_1 + 3x_2 + 4x_3 + 7x_4$

Subject to $2x_1 + 3x_2 - x_3 + 4x_4 = 8$,

$$x_1 - 2x_2 + 6x_3 - 7x_4 = -3$$

and $x_1, x_2, x_3, x_4 \geq 0$

(d) Solve the following LPP by simplex method

Maximize $Z = 5x_1 + 3x_2$

Subject to

$x_1 + x_2 \leq 2$, $5x_1 + 2x_2 \leq 10$, $3x_1 + 8x_2 \leq 12$

and $x_1, x_2 \leq 0$

(e) Use two-phase method to solve the following LPP

Minimize $Z = \frac{15}{2}x_1 - 3x_2$

Subject to $3x_1 - x_2 - x_3 \geq 3$,

$x_1 - x_2 + x_3 \geq 2$

and $x_1, x_2, x_3 \geq 0$.

(f) Write 'T' for true and 'F' for false :

(i) If an LPP has two feasible solutions, then it has infinite number of solutions.

(ii) An LPP with more than two variables cannot be solved by graphical method.

(iii) An LPP cannot have more than one redundant constraint.

(iv) Every LPP has a solution

(v) The graphical approach to solve an LPP is applicable when the number of variables is more than the number of constraints.

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

(a) What do you understand by a transportation problem ? Give the mathematical formulation of the transportation problem.

(b) Find the initial solution to the following transportation problem using Vogel's Approximation Method (VAM) :

Factory	Denstination				Supply
	D_1	D_2	D_3	D_4	
F_1	3	3	4	1	100
F_2	4	2	4	2	125
F_3	1	5	3	2	75
Demand	120	80	75	25	300

(c) Explain a trans-shipment problem. What are the main characteristics of trans-shipment problem ?

(d) Four jobs are to be done on four different machines. The cost in rupees of producing i^{th} job on the j^{th} machine is given below :

Jobs (J_i)	***Machines*** (M_j)			
	M_1	M_2	M_3	M_4
J_1	15	11	13	15
J_2	17	12	12	13
J_3	14	15	10	14
J_4	16	13	11	17

Assign the jobs to different machines so as to minimize the total cost.

(e) Solve the following integer programming problem using branch and bound method :

Maximize $Z = 3x_1 + 5x_2$

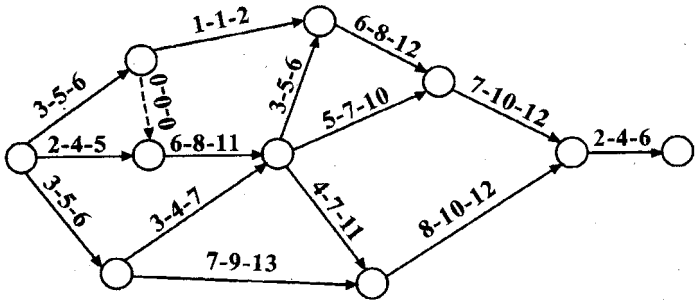
Subject to $2x_1 + 4x_2 \leq 25$, $x_1 \leq 8$, $x_2 \leq 10$

and $x_1, x_2 \geq 0$ and both are integers.

(f) What do you understand by integer programming problem ? Distinguish between pure and mixed integer programming problems.

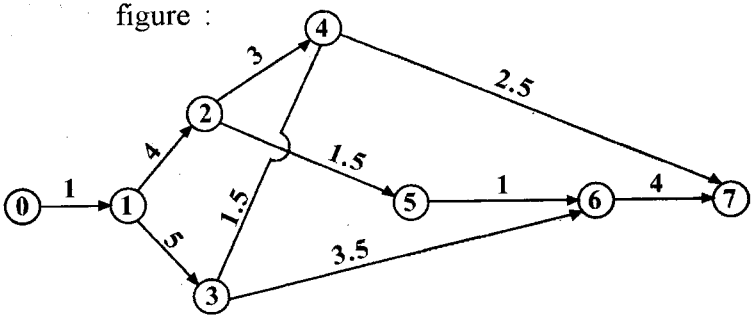
3 Attempt any two of the following : **10×2=20**

(a) Calculate the variance and expected activity time for the activities of the network shown in the following figure (Enter calculations in the tabular form)



For each activity, the three estimates t_0, t_m and t_p are given along the arrows in the $t_0 - t_m - t_p$ order.

(b) Cosndier the network shown in the following figure :



Determine the total float, free float, independent float and identify the critical path.

(c) There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times are given in the following table :

Processing time (in hours) for the jobs

Machines	1	2	3	4	5
Machine – A	5	9	1	3	8
Machine – B	6	7	2	4	10

Determine a sequence of the five jobs that will minimize the total elapsed time T. Calculate the total idle time for the machines in this period.

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

(a) A particular item has a demand of 9000 units per year. The cost of one procurement is Rs. 100 and the holding cost per unit is

Rs. 2.40 per year. The replacement is instantaneous and no shortages are allowed. Find (i) the economic lot size (ii) the number of orders per year, (iii) the time between the orders and (iv) the total cost per year if the cost of one unit is Re. 1.

(b) A machine costs Rs. 10,000. Its operating costs and resale values are given below

Year	1	2	3	4	5	6	7	8
Operating Cost (in rupess)	1000	1200	1400	1700	2000	2500	3000	3500
Resale value (in rupees)	6000	4000	3200	2600	2500	2400	2000	1600

Determine at what time it could be replaced ?

(c) The following mortality rates have been observed for a certain type of light bulbs :

Week	1	2	3	4	5
Percent failing by the end of week	10	25	50	80	100

There are 1000 bulbs in use and it costs Rs. 2 to replace an individual bulb which has burnt out. If all the bulbs were replaced simultaneously, it would cost Re. 0.50 per bulbs. It is proposed to replace all bulbs at fixed intervals of time, whether or not they have burnt out and to continue replacing burnt out bulbs as and when they fail. At what intervals, should all the bulbs be replaced ?

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

(a) What do you mean by inventory ? What are the ma objectives of inventory control ? Why do inventorie play an extremely important role in any organization

(b) Use dynamic programming to solve the followin LPP :

Maximize $Z = 3x_1 + 5x_2$

Subject to $x_1 \leq 4,\ x_2 \leq 6,\ 3x_1 + 2x_2 \leq 18$ and

$x_1,\ x_2 \geq 0$

(c) What is dynamic programming problem ? What ar the essential characteristics of it ? What is Beelman's principle of optimality ?
