Reg. No..... (Pages : 4) **K 5183**

Name.....

SIXTH SEMESTER B.C.A. DEGREE EXAMINATION, MARCH/APRIL 2005

(Vocational Course)

Optional Subject : Mathematics

Paper XII—OPERATIONS RESEARCH

Time : Three Hours Maximum : 90 Marks

Unit I

(*Maximum* : 40 *marks*)

1. Prove the following :—

   (a) Every hyperplane is a convex set. (3 marks)

   (b) The intersection of two convex sets is also a convex set. (4 marks)

2. Describe the scope of operations research. (8 marks)

3. Explain the simplex algorithm to solve an L.P.P. (10 marks)

4. Use dual simplex method to solve the following L.P.P. :—

   Maximize $Z = -2x_1 - 2x_2 - 4x_3$

   subject to the constraints

   $$\begin{aligned} 2x_1 + 3x_2 + 5x_3 &\geq 2 \\ 3x_1 + x_2 + 7x_3 &\leq 3 \\ x_1 + 4x_2 + 6x_3 &\leq 5 \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

   (10 marks)

5. Use simplex method to solve the following L.P.P. :—

   Maximize $Z = x_1 + 2x_2$

   subject to the constraints

   $$\begin{aligned} x_1 + x_2 &\leq 10 \\ 2x_1 - x_2 &\leq 40 \\ x_1, x_2 &\geq 0. \end{aligned}$$

   (10 marks)

6. State and prove the fundamental theorem of duality. (5 marks)

Turn over

7. Use Big-M method to

Maximize $Z = 3x_1 + 2x_2 + 3x_3$

subject to the constraints :

$$2x_1 + x_2 + x_3 \leq 2$$
$$3x_1 + 4x_2 + 2x_3 \geq 8$$
$$x_1, x_2, x_3 \geq 0.$$

(10 marks)

Unit II

(*Maximum* : 40 *marks*)

8. Determine an initial basic feasible solution to the following transportation problem using the North-West corner rules :

	D_1	D_2	D_3	D_4	
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
	6	10	15	4	

Availability

Requirement

where O_i and D_j represent the i^{th} origin and j^{th} destination respectively.

(7 marks)

9. Obtain an initial basic feasible solution to the following T.P. using Vogel's approximation method :—

Warehouses	*Stores*				*Availability*
	I	II	III	IV	
A	5	1	3	3	34
B	3	3	5	4	15
C	6	4	4	3	12
D	4	– 1	4	2	19
Requirement	21	25	17	17	80

(8 marks)

10. State the assignment problem. Describe an algorithm for the solution of the assignment problem.

(7 marks)

11. Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows :

Persons	*Jobs*				
	1	2	3	4	5
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

Determine the optimum assignment schedule.

(8 marks)

12. Solve the following 2 × 3 game graphically.

		Player B	
		B_1	B_2
Player A	A_1	−2	5
	A_2	0	−2
	A_3	1	−4

(8 marks)

13. Using dominance property, solve the game whose payoff matrix is given by :

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	3	2	4	0
	A_2	3	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

(7 marks)

14. The cost of a machine is Rs. 6,100 and its scrap value is only Rs. 100. The maintenance costs are found from experience to be :

Year	:	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	}	100	250	400	600	900	1,250	1,600	2,000

When should the machine be replaced.

(7 marks)

15. The following table gives the running cost per year and resale price of certain equipment, whose purchase price is Rs. 5,000 :—

Year	1	2	3	4	5	6	7	8
Running cost (Rs.)	1,500	1,600	1,800	2,100	2,500	2,900	3,400	4,000
Resale value (Rs.)	3,500	2,500	1,700	1,200	800	500	500	500

At what year is the replacement due.

(8 marks)

Unit III

(*Maximum* : 10 *marks* ; 2 *marks each*)

16. Define Slack variables.

17. Mention the rules for dominance.

18. Define a quadratic form.

19. Write the standard form of the following L.P.P. :—

Minimize $Z = 2x + 4y$ subject to the constraints

$$\begin{aligned} 2x + y &\leq 3 \\ x - y &\geq 4 \\ x + 2y &= 5 \\ x, y &\geq 0. \end{aligned}$$

20. What is degeneracy in Transportation problem ?