E 6540 (Pages : 4) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2017

Second Semester

Complementary Course—OPERATIONS RESEARCH—DUALITY TRANSPORTATION AND ASSIGNMENT PROBLEMS

(For B.Sc. Mathematics Model II)

[2013 Admission onwards]

Time : Three Hours Maximum Marks : 80

Part A

Answer **all** *questions.*
Each question carries **1** *mark.*

1. In the primal problem if the objective is to maximise, then what is the objective in the dual problem.
2. What is the relationship between the matrix of the coefficients of variables in the dual and primal problems ?
3. What is the relation between the optimum values of the objective functions of the Primal and dual Problems ?
4. With reference to a transportation problem define the term feasible solution.
5. Define loop of a transportation table.
6. Define the term triangular basis.
7. What is the minimum number of cells in a loop ?
8. What is degeneracy in transportation problem ?
9. Can there be multiple optimal solutions to an assignment problem.
10. What is a balanced transportation problem ?

(10 × 1 = 10)

Part B

Answer any **eight** *questions.*
Each question carries 2 *marks.*

11. Write the dual of the problem :

$$\begin{aligned} \text{Minimize } Z = \; & x_1 - 3x_2 - 2x_3 \\ \text{subject to } \; & 3x_1 - x_2 + 2x_3 \leq 7 \\ & 2x_1 - 4x_2 \geq 12 \\ & -4x_1 + 3x_2 + 8x_3 = 10 \\ & x_1, x_2 \geq 0, \; x_3 \text{ unrestricted.} \end{aligned}$$

Turn over

12. Define the dual of a linear programming problem.
13. What are the rules for constructing the dual from the primal ?
14. State the transportation problem.
15. Discuss the test for optimality in a transportation problem.
16. What is meant by unbalanced transportation problem ?
17. Describe the matrix form of a transportation problem.
18. How can the optimal solution of primal be obtained from the optimal solution of the dual ?
19. How are overcomes degeneracy in a transportation problem ?
20. Describe the assignment problem.
21. State travelling salesman problem.
22. With any three methods of solving an assignment problem.

$(8 \times 2 = 16)$

Part C

Answer any **six** *questions.*
Each question carries 4 marks.

23. Prove that if the primal problem is feasible, then it has an unbounded optimum if and only if the dual has no feasible solution,and vice versa.
24. Prove that dual of the dual is the primal.
25. Solve graphically to show that the following problem has an unbounded solution :

    Maximise $3x_1 + 4x_2$ subject to

    $$x_2 - x_1 \leq 1$$
    $$x_1 + x_2 \geq 4$$
    $$x_1 - 3x_2 \leq 3, x_1 \geq 0, x_2 \geq 0$$

26. Solve the following transportation problem for minimum cost starting with the degenerate solution $x_{12} = 30, x_{21} = 40, x_{32} = 20, x_{43} = 60$:

	D_1	D_2	D_3	
O_1	4	5	2	30
O_2	4	1	3	40
O_3	3	6	2	20
O_4	2	3	7	60
	40	50	60	

27. Explain how to resolve degeneracy in transportation problem.

28. A steel company has three open hearth furnaces and five rolling mills. Transportation costs (rupees per quintal) for shipping steel from furnaces to rolling mills are shown below :

	M_1	M_2	M_3	M_4	M_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

What is the optimal shipping schedule ?

29. Explain the difference between a transportation and an assignment problem.

30. Give an algorithm to solve an assignment problem.

31. Explain the transhipment problem.

$(6 \times 4 = 24)$

Part D

Answer any **two** *questions.*
Each question carries 15 *marks.*

32. Solve by dual simplex method :

Minimise $x_1 + 3x_2 + 2x_3$ subject to

$4x_1 - 5x_2 + 7x_3 \leq 8$, $2x_1 - 4x_2 + 2x_3 \geq 2$,

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

33. Four operators A, B, C, D are to be assigned to four machines M_1, M_2, M_3, M_4 with the restriction that A and C cannot work on M_3 and M_4 respectively. The assignment costs are given below. Find the minimum assignment cost :

	M_1	M_2	M_3	M_4
A	5	2	—	5
B	7	3	2	4
C	9	—	5	3
D	7	7	6	2

34. A salesman has to visit five cities A, B, C, D and E. The distance C (in hundred kms) between the five cities are as follows :

	A	B	C	D	E
A	—	7	6	8	4
B	7	—	8	5	6
C	6	8	—	9	7
D	8	5	9	—	8
E	4	6	7	8	—

If the salesman starts from city A and has come back to city A, which route should be select so that total distance travelled is minimum.

35. Describe the caterer problem.

(2 × 15 = 30)