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Reg. No.....

Name.....

B.C.A. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2024

Fourth Semester

Complementary Course—OPERATIONAL RESEARCH

(2013–2016 Admissions)

Time : Three Hours Maximum Marks : 80

Part A

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

1. Write any one use of Operational Research to a personal administrator.
2. Write any one use of Operational Research to a financial controller.
3. What is an unbounded region ? Give an example.
4. Define the term feasible solution associted to a L.P.P.
5. Define slack and surplus variables.
6. When is a mathematical programming problem called a linear one ?
7. Define the term loop associated to a transportation problem.
8. What is a balanced transportation problem ?
9. Define a zero sum game.
10. Define a saddle point.

(10 × 1 = 10)

Part B

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

11. What are the characteristics of Operational Research ?
12. What are the advantages of Operational Research in decision-making ?
13. What is a deterministic model ?
14. Write the matrix form of a standard L.P.P.
15. When is a Mathematical programming problem called a linear one ?
16. Define the term degenerate solution.

Turn over

17. Write a note on simplex method.

18. Describe the matrix form of a transportation problem.

19. Formulate the transportation problem as a L.P.P.

20. Explain North-West Corner method.

21. What are the assumptions made in the theory of games ?

22. Explain the difference between pure and mxed strategies.

(8 × 2 = 16)

Part C

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

23. Discuss the significance and scope of Operational Research in modern management.

24. What are the areas of applications of Operational Research ?

25. A manufacturer has three machines A, B, C with which be produces three different articles P, Q, R. The different machine times required per article, the amount of time available in any week on each machine and the estimated profit per article are given below :

Article	Machine time (in hrs) on each machine			Profit per article in E
	A	B	C	
P	8	4	2	20
Q	2	3	0	6
R	3	0	1	8
Available Machine hrs	250	150	50	

Formulate the problem as a L.P.P.

26. Solve graphically :

Maximize $Z = x_1 + 3x_2$

subject to the constraints

$$3x_1 + 6x_2 \leq 8$$
$$5x_1 + 2x_2 \leq 10$$
$$x_1, x_2 \geq 0.$$

27. Use Simplex method to solve the L.P.P. :

Maximize $Z = 7x_1 + 5x_2$

subject to the constraints

$$\begin{aligned} x_1 + 2x_2 &\leq 6 \\ 4x_1 + 3x_2 &\leq 12 \\ x_1, x_2 &\geq 0. \end{aligned}$$

28. Use North-West Corner rule to determine an initial basic feasible solution to the transportation problem :

	To			
From	2	7	4	5
	3	3	1	8
	5	4	7	7
	1	6	2	14
Demand	7	9	18	34

Supply

29. Write a short note and degeneracy in T.P.

30. For the game with the pay-off matrix :

$$\text{Player B} \begin{bmatrix} -1 & 2 & -2 \\ 6 & 4 & -6 \end{bmatrix} \quad \text{Player A}$$

Determine the best strategies for players A and B and also the value of the game. Is this game fair ? Is strictly determinable.

31. Explain the following terms :

(a) Competitive game.

(b) Saddle point.

(c) Optimal strategies.

$(6 \times 4 = 24)$

Turn over

Part D

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

32. Use big M method to solve :

Minimize $Z = 4x_1 + 2x_2$

subject to the constraints

$$\begin{aligned} 3x_1 + x_2 &\geq 27 \\ x_1 + x_2 &\geq 21 \\ x_1 + 2x_2 &\geq 30 \\ x_1, x_2 &\geq 0. \end{aligned}$$

33. A company has factories at F_1, F_2 and F_3 which supply warehouses at W_1, W_2 and W_3. Weekly factory capacities are 200, 160 nd 90 units respectively. Weekly warehouse requirements are 180, 120 and 150 units respectively. Unit shipping cost in rupees are as follows :

	Warehouses			
Factories	W_1	W_2	W_3	Supply
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	450

Determine the optimal distribution for their company to maximize shipping costs.

34. Five jobs 1, 2, 3, 4 and 5 are to be assigned to 5 persons A, B, C, D and E. The time taken (in minutes) by each of them on each job is given below :

	1	2	3	4	5
A	16	13	17	19	20
B	14	12	13	16	17
C	14	11	12	17	18
D	5	5	8	8	11
E	5	3	8	8	10

Work out the optimal assignment and the total minimum time taken.

35. (a) Explain the theory of dominance in the solution of rectangular games.

(b) Use the concept of dominance to reduce the size of the matrix of the given problem to 2×2 matrix and solve the game. The pay-off matrix is given by :

$$\begin{array}{c} \\ \text{Player A} \end{array} \begin{array}{c} \text{Player B} \\ \begin{bmatrix} 1 & 8 & 3 \\ 6 & 4 & 5 \\ 0 & 1 & 2 \end{bmatrix} \end{array}$$

$(2 \times 15 = 30)$