E 1945 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, APRIL 2021

Sixth Semester

Choice Based Course—OPERATIONS RESEARCH

(For B.Sc. Mathematics Model I)

[2013—2016 Admissions]

Time : Three Hours Maximum Marks : 80

Part A

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

1. Define a Euclidean space.
2. What do you mean by linear independence of a set of vectors ?
3. Define convex hull of a set.
4. Define feasible solution of a L.P.P.
5. Define artificial variables.
6. What are slack variables ?
7. Define the terms source and sink associated with a transportation problem.
8. What is an unbalanced transportation problem ?
9. What is queue discipline ?
10. Define the term busy period associated with queue.

$(10 \times 1 = 10)$

Part B

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

11. Do the following vectors form a basis set for E_3 [3, 0, 2]; [7, 0, 9], [4, 1, 2]. Justify your answer.
12. Define the terms separating and supporting hyper planes.
13. Write the standard form of a linear programming problem.
14. What is an unbounded solution of a LPP ?
15. Define the terms basic feasible solution and degenerate solution of LPP.
16. Discuss duality in linear programming.

Turn over

17. When is it advantageous to solve an LPP by dual simplex method.

18. Write the dual of the problem, maximise $3x_1 + 4x_2$

subject to constraints

$2x_1 + 3x_2 \leq 16$

$5x_1 + 2x_2 \geq 20, x_1, x_2 \geq 0.$

19. Describe the matrix form of the transportation problem.

20. Define the terms transient state and steady state associated to a queue.

21. State the components of a queue.

22. What is a pure death process ?

$(8 \times 2 = 16)$

Part C

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

23. Solve graphically maximize $Z = 3x_1 + 2x_2$

subject to the constraints :

$x_1 - x_2 \leq 1$

$x_1 + x_2 \geq 3, x_1, x_2 \geq 0.$

24. Show that the set $\{(x_1, x_2) : x_1^2 - x_2^2 \leq 4\}$ is a convex set.

25. Prove that a basic feasible solution of the LPP is a vertex of the convex set of feasible solutions.

26. Use simplex method to solve the problem :

Maximise $Z = 2x_1 + x_2$

subject to the constraints :

$x_1 + 2x_2 \leq 10, x_1 + x_2 \leq 6, x_1 - x_2 \leq 2, x_1 - 2x_2 \leq 1, x_1, x_2 \geq 0.$

27. Show that dual of the dual is the primal.

28. Use the North-West corner rule to determine on 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
	7	9	18	34

Supply

Demand

29. Explain Vogel's approximation method of solving a transportation problem.

30. Explain the terms (i) Service time ; (ii) Queue length ; (iii) Traffic intensity ; (iv) Idle period associated to a queue.

31. Explain the dynamic arrival process of customers to the service system.

$(6 \times 4 = 24)$

Part D

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

32. Use dual simplex method to solve :

Minimise $Z = 2x_1 + 3x_2 + 4x_3$

subject to the constraints :

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

33. Use Big M method to solve the problem :

Maximize $Z = 3x_1 - x_2$

subject to the constraints :

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

34. (a) The following table represents the cost of assigning three jobs to three workers. Work out the optimal assignment :

		Job A	Job B	Job C
Worker	1	4	7	8
	2	5	3	2
	3	6	5	4

(b) Give the computational procedure to solve an assignment problem.

35. (a) People arrive at a theater ticket booth in a Poisson distributed arrival rate of 25 per hour. Service time is constant at 2 mininutes. Calculate (i) The mean number in the waiting line ; (ii) The mean waiting time ; (iii) The utilization factor.

(b) Give some important applications of queueing theory.

$(2 \times 15 = 30)$