Reg. No.. Name.. **19U655**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2019

SEMESTER **– 6: MATHEMATICS (CORE COURSE)**

COURSE: **15U6CRMAT13: OPERATIONS RESEARCH**

(Common for Regular - 2016 Admission / Supplementary-Improvement 2015/2014 admissions)

Time: Three Hours Max. Marks: 75

SECTION A

Answer ***all*** questions

1. Define convex Hull of a set.
2. What is meant by extreme point of a convex set?
3. Define norm of a vector space.
4. The optimal solution to a linear programming problem is always unique .True or False.
5. Define artificial variables.
6. Define Loop of a transportation problem
7. Define a balanced transportation problem.
8. What do you mean by queue discipline?
9. Define waiting time of a customer in the system.
10. What is meant by traffic intensity? (1 x 10 = 10)

SECTION B

Answer ***any Eight*** questions

11. Define subspace of a vector space with one example
12. Write the standard form of the linear programming problem (L.P.P).
13. Formulate the L.P.P

    A person has option of investing Rs.10, 000 in two plans A and B, plan A guarantees a return of 50 paisa on each rupee invested after a period of 3 years and plan B guarantees that each rupee invested will an one and a half rupees after six years .How should the person invest his money to maximize his earnings on a period of 6 years, if he is not willing to invest more than 60% in B?
14. Show that the vector $[\,1-2 \quad -2]^1$ and $[2-1\ \ 2]^1$ are orthogonal. Find a vector orthogonal to both these vectors.
15. Write the dual of the following L.P.P

    Min $x_1 + x_2$

    Sub $2x_1 + x_2\ \geq 8$

    $3x_1 + 7x_2 \geq 21$

    $x_1, x_2 \geq 0$
16. Find the initial basic feasible solution of the transportation problem.

	D_1	D_2	D_3	D_4	
O_1	4	5	8	3	50
O_2	5	4	3	2	30
O_3	1	5	6	3	20
	40	30	20	10	

17. Show that an assignment problem in a special type of linear programming problem
18. Write the different queue discipline.
19. Describe service time distribution.
20. Describe customer's behaviour in a queue. (2 x 8 = 16)

SECTION C

Answer ***any Five*** questions

21. Show that vertex S_F {set of Basic feasible solution} is a basic feasible solution.
22. Solve graphically.

    Minimize $-4x_1 - 5x_2$

    Subject to $x_1 - 2x_2 \leq 2$

    $2x_1 + x_2 \leq 6$

    $x_1 + 2x_2 \leq 5$

    $-x_1 + x_2 \leq 2$

    $x_1, x_2 \geq 0$
23. Solve by dual simplex method

    Minimize $2x_1 + 3x_2$

    Subject to $2x_1 + 3x_2 \leq 30$

    $x_1 + 2x_2 \geq 10$

    $x_1, x_2 \geq 0$
24. Find the initial Basic solution of the transportation problem by VAM and find the cost.

	D_1	D_2	D_3	D_4	
s_1	19	30	50	10	7
s_2	70	30	40	60	9
s_3	40	8	70	20	18
	5	8	7	14	34

25. A department has five employees with 5 jobs to be performed. The time in hours each men will take to perform each job is given with effectiveness matrix.

	1	2	3	4	5
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

How should the jobs be allotted one per employee so has to minimize the total man hours?

26. Show that if $X \in E_n,\ V \subseteq E_n$ such that $V = \{ X \mid X = [x_1, \ldots\ldots, x_n]' \mid x_1 + x_2 + \cdots + x_n = 0 \}$ then V is subspace of E_n.
27. If the no. of arrivals n, in time t follows Poisson distribution. Find the distribution of the inter arrival times.

(5 x 5 = 25)

SECTION D

Answer ***any Two*** questions

28. Solve by Two phase simplex Method.

Minimize $2x_1 - 3x_2 + 6x_3$

Subject to $3x_1 - 4x_2 - 6x_3 \leq 2$

$2x_1 + x_2 + 2x_3 \geq 11$

$x_1 + 3x_2 - 2x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$

29. Solve by simplex method.

Maximise $x_1 + x_2 + x_3$

Subject to $2x_1 + x_2 + 2x_3 \leq 2$

$4x_1 + 2x_2 + x_3 \leq 2$

$x_1, x_2, x_3 \geq 0$

30. Solve the transportation problem. Food bags have to be lifted by 3 different types of aircraft A_1, A_2, A_3 from an airport and dropped in flood affected villages$V_1, V_2, V_{3,} V_4, V_5$. The quantity of food that can be carried in one trip by aircraft.A_i to village v_j is given in the following table. The total no: of trips that A_i can make in a day is given in the last column .The no: of trip possible each day to village v_i is given in the last row. Find the no: of trips each aircraft should make on each village so that the total quantity of food transported in a day is maximum.

	V_1	V_2	V_3	V_4	V_5	
A_1	10	8	6	9	12	50
A_2	5	3	8	4	10	90
A_3	7	9	6	10	4	60
	100	80	70	40	20	

31. If the arrivals are completely random. Show that the probability distribution of no: of arrivals in fixed time interval follows a Poisson distribution.

(12 x 2 = 24)

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