K18U 0125

Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Imp.)
Examination, May 2018
CORE COURSE IN MATHEMATICS
6B14 MAT : (Elective – A) : Operation Research
(2014 Admn. Onwards)

Time : 3 Hours Max. Marks : 48

SECTION – A

All the **first 4** questions are **compulsory.** They carry **1** mark **each**.

1. Give a subset of $\mathbb{R}^2$ which is not convex.

2. Let f(x) be a convex function on a convex set S. Then the set of points in S at which f(x) takes on its global minimum, is a convex set. True or false.

3. When do you say that a transportation problem is unbalanced ?

4. What is the number of basic variables of the general transportation problem at any stage of feasible solution ? **(1×4=4)**

SECTION – B

Answer **any 8** questions from among the questions **5** to **14**. These questions carry **2** marks **each**.

5. What is the standard form of L.P.P. ? What are its characteristics ?

6. Show that the set of feasible solutions to an L.P.P. is a convex set.

7. Solve graphically the following L.P.P.
   Maximize $z = 4x_1 + 3x_2$ subject to the constraints :
   $2x_1 + x_2 \leq 1000, x_1 + x_2 \leq 800, x_1 \leq 400, x_2 \leq 700, x_1 \geq 0, x_2 \geq 0.$

P.T.O.

8. Obtain the dual of the following L.P.P. :

   Maximize $f(x) = 2x_1 + 5x_2 + 6x_3$ subject to the constraints :

   $5x_1 + 6x_2 - x_3 \leq 3, -2x_1 + x_2 + 4x_3 \leq 4, x_1 - 5x_2 + 3x_3 \leq 1, -3x_1 - 3x_2 + 7x_3 \leq 6,$
   $x_1, x_2, x_3 \geq 0.$

9. Obtain an initial basic feasible solution to the following transportation problem using the matrix minima method.

	D_1	D_2	D_3	D_4	**Capacity**
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

10. Obtain an initial basic feasible solution to the following transportation problem using the north-west corner rule.

	D_1	D_2	D_3	D_4	**Availability**
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	34
Demand	16	18	31	25	

11. Use Vogel's approximation method to obtain an initial basic feasible solution to the following transportation problem :

	D	**E**	**F**	**G**	**Available**
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

12. Given below is an assignment problem. Write it as a transportation problem.

	A_1	A_2	A_3
R_1	1	2	3
R_2	4	5	1
R_3	2	1	4

13. Six jobs go first over Machine I and then over Machine II. The order of the completion of jobs has no significance. The following table gives the machine times in hours for six jobs and the two machines :

Job No.	:	1	2	3	4	5	6
Time on Machine I (A_i)	:	5	9	4	7	8	6
Time on Machine II (B_i)	:	7	4	8	3	9	5

Find the sequence of jobs that minimizes the total elapsed time to complete the jobs and the minimum total time.

14. Write a short note on maintenance crew scheduling. (2×8=16)

SECTION – C

Answer **any 4** questions from among the questions **15** to **20**. These questions carry **4** marks **each**.

15. Define the following types of quadratic forms and give example for each type.
    a) Positive definite
    b) Negative definite
    c) Negative semi-definite
    d) Indefinite

16. Let $x_1 = 2$, $x_2 = 4$ and $x_3 = 1$ be a feasible solution to the system of equations $2x_1 - x_2 + 2x_3 = 2$, $x_1 + 4x_2 = 18$.
    Reduce the given feasible solution to a basic feasible solution.

17. State and prove the reduction theorem with respect to the assignment problem.

18. Solve the following transportation problem.

	To			
From	**A**	**B**	**C**	**Available**
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Requirement	4	2	2	

19. A machine shop has four machines A, B, C and D. Two jobs must be processed through each of these machines. The time in hours taken on each of the machines and the necessary sequence of jobs through the shop are given below :

Job 1	Sequence	A	B	C	D
	Time	2	4	5	1
Job 2	Sequence	D	B	A	C
	Time	6	4	2	3

Use graphic method to obtain the total minimum elapsed time.

20. Explain the Maximin-Minimax Principle. (4×4=16)

SECTION – D

Answer **any 2** questions from among the questions **21** to **24**. These questions carry **6** marks **each**.

21. Solve the following problem by Simplex method :

    Maximize $z = x_2 - 3x_3 + 2x_5$ subject to the constraints $3x_2 - x_3 + 2x_5 \le 7$, $-2x_2 + 4x_3 \le 12$, $-4x_2 + 3x_3 + 8x_5 \le 10$, $x_2, x_3, x_5 \ge 0$.

22. A company wishes to assign 3 jobs to 3 machines in such a way that each job is assigned to some machine and no machine works on more than one job. The cost of assigning job i to machine j is given by the following matrix.

    $$\text{Cost matrix : } \begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}.$$

    Draw the associated network. Formulate the network L.P.P. and find the minimum cost of making the assignment.

23. Solve the following 2 – person zero-sum game :

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

24. Use matrix oddment method to solve the following 3 × 3 game :

    $$\begin{pmatrix} 0 & 1 & 2 \\ 2 & 0 & 1 \\ 1 & 2 & 0 \end{pmatrix}.$$

(6×2=12)
