K17U 0371

Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS – Regular) Examination, May 2017
(2014 Admn.)
CORE COURSE IN MATHEMATICS
(Elective – A)
6B14 MAT : Operations Research

Time : 3 Hours   Max. Marks : 48

SECTION – A

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

1. What is an n-dimensional simplex ?
2. Define convex functions.
3. When do you say that a transportation problem is balanced ?
4. How do you check from the transportation table that a feasible solution is basic or not ? (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 canonical form of L.P.P. ? What are its characteristics ?
6. Solve the following problem graphically :

   Maximize z = x + 3y subject to the constraints $x + y \le 50$, $2x + y \le 60$, $x \ge 0$, $y \ge 0$.
7. Reduce the following L.P.P. to its standard form :

   Determine $x_1 \ge 0, x_2 \ge 0, x_3 \ge 0$ so as to maximize $z = 2x_1 + x_2 + 4x_3$ subject to the constraints : $-2x_1 + 4x_2 \le 4$, $x_1 + 2x_2 + x_3 \ge 5$, $2x_1 + 3x_3 \le 2$.

P.T.O.

8. Obtain the dual of the following L.P.P. :
Maximize $z = 2x_1 + x_2$ subject to the constraints :
$x_1 + 5x_2 \leq 10$, $x_1 + 3x_2 \geq 6$, $2x_1 + 2x_2 \leq 8$, $x_2 \geq 0$ and x_1 unrestricted.

9. Explain the assignment problem and formulate it mathematically.

10. What is meant by degeneracy in transportation problem ? How do you resolve degeneracy at the initial solution ?

11. Show that a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem is that $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$.

12. Obtain an initial basic feasible solution to the following transportation problem using the North-West corner rule.

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

13. Explain the problem of sequencing with an example.

14. We have five jobs, each of which must go through the two machines A and B in the order AB. Processing times in hours are given in the table below :

Job (i)	: 1	2	3	4	5
Machine A(A_i)	: 5	1	9	3	10
Machine B(B_i)	: 2	6	7	8	14

Determine a sequence for five jobs that will minimize the elapsed time. **(2×8=16)**

SECTION – C

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

15. Use simplex method to solve the L.P.P. :
Maximize $z = 3x_1 + 2x_2$ subject to the constraints :
$x_1 + x_2 \leq 6$, $2x_1 + x_2 \leq 6$, $x_1 \geq 0$, $x_2 \geq 0$.

16. Let f(x) be differentiable in its domain. If f(x) is defined on an open convex set S, show that f(x) is convex if and only if $f(x_2) - f(x_1) \geq (x_2 - x_1)^T \nabla f(x_1)$.

17. Solve the following transportation problem :

From	To A	B	C	Available
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Demand	6	10	15	

18. Solve the following assignment problem :

$$\begin{array}{c} \\ I \\ II \\ III \\ IV \end{array}\begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 1 & 4 & 6 & 3 \\ 9 & 7 & 10 & 9 \\ 4 & 5 & 11 & 7 \\ 8 & 7 & 8 & 5 \end{bmatrix} \end{array}$$

19. Use graphical method to minimize the time added to process the following jobs on the machines shown, i.e., for each machine find the job which should be done first. Also calculate the total time elapsed to complete both the jobs :

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

20. In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and losses $\frac{1}{2}$ unit of value when there are one head and one tail. Determine the payoff matrix, the best strategies for each player and the value of the game to A. **(4×4=16)**

SECTION – D

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

21. Find the maximum value of $z = 4x_1 + 10x_2$ subject to the constraints $2x_1 + x_2 \le 50$, $2x_1 + 5x_2 \le 100$, $2x_1 + 3x_2 \le 90$, $x_1 \ge 0$ and $x_2 \ge 0$.

22. Consider the following transportation table showing production and transportation costs along with the supply and demand positions of factories.

	M_1	M_2	M_3	M_4	Supply
F_1	4	6	8	13	500
F_2	13	11	10	8	700
F_3	14	4	10	13	300
F_4	9	11	13	3	500
Demand	250	350	1050	200	

a) Obtain an initial basic feasible solution by using VAM.

b) Find out an optimal solution for the above given problem.

23. Solve the following game :

Player B

Player A	**I**	**II**	**III**	**IV**
I	3	2	4	0
II	3	4	2	4
III	4	2	4	0
IV	0	4	0	8

24. Consider the 2×2 game : $\begin{pmatrix} 4 & 7 \\ 6 & 5 \end{pmatrix}$

a) Does it have a saddle point ?

b) Is it correct to state that the value of game, G will be $5 < G < 6$?

c) Determine the frequency of optimum strategies by matrix oddment method and find the value of game. **(6×2=12)**

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