BRAINWARE UNIVERSITY

Course –BSc(CS)

Mathematics-III (BCS402)

(Semester – 4)

Time allotted: 3 Hours **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question) 10 x 1 = 10

1. *Choose the correct alternative from the following:*

(i) The dual of a dual is

a. Dual b. primal

c. both primal and dual d. none of these

(ii) Identify the type of the feasible region given by the set of inequalities:

$x + y \geq 1$
$x + y \leq 2$

where both x and y are non-negative.

a. A triangle b. quadrilateral

c. An unbounded region d. An empty region

(iii) Consider the following

$3x - 2y \leq 1$

$-x + 3y \geq -1$

for non-negative x and y. Which of the following points are feasible: A(0,0), B(1,1), C(2,2) ?

a. A, B and C b. A and B

c. A and C d. B and C

(iv) The basic feasible solution of the system of equations $x_1 + x_2 + x_3 = 8;\ 3x_1 + 2x_2 = 18$ are

a. No basic solution b. (2,6,0) (6,0,2)

c. (1,7,0) (7,1,0) d. (2,2,0) (6,6,2)

(v) In the following L.P.P :

$$\text{Minimize } z = 3x_1 + 8x_2 + 3x_3 + 7x_4$$
$$\text{subject to } 3x_1 + 5x_2 + x_3 \geq 16$$
$$5x_1 + 3x_2 - x_4 \geq 12$$
$$x_1, x_2, x_3, x_4 \geq 0$$

the number of artificial variables required to initialize the simplex table is

a. 1 b. 2
c. 3 d. 0

(vi) The number of basic variables in a transportation problem of m sources and n destinations, is at most

a. m+n-1 b. m+n
c. mn d. mn+1

(vii) An assignment problem can be solved by

a. Hungarian method b. VAM
c. Matrix minima method d. none of these

(viii) When the total availability is not equal to the total demand, that type of transportation problem is known as

a. Balanced transportation problem b. unbalanced transportation problem
c. Infeasible transportation problem d. Non-degeneracy

(ix) In a fair game the value of the game is

a. Infeasible b. 0
c. Unbounded d. Degenerate

(x) Full form of PERT is

a. Program Estimation & Review Technique b. Project Evaluation & Review Technique
c. Project Estimation & Research Technique d. Program Evaluation & Review Technique

Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following :

2. Write the L.P.P in standard maximization form:

$$\text{Max } z = 3x_1+4x_2+7x_3$$

Subject to

$$2x_1+x_2+7x_3 \leq 50$$
$$x_1+9x_2-5x_3 \geq 60$$
$$5x_1+3x_3 = 100$$
$$3x_2+4x_3 \leq 80$$
$$\text{for } x_1,x_2,x_3 \geq 0$$

[5]

3. Using Graphical method show that the following L.P.P has degenerate solution

$$Max\, z = 4x_1 + 3x_2$$

subject to

$$2x_1 + 3x_2 \leq 8$$
$$3x_1 + 2x_2 \leq 12$$
$$x_1, x_2 \geq 0$$

[5]

4. Find all the basic feasible solutions of the following system of equations

$$x_1 + x_2 + x_3 = 4$$
$$2x_1 + 5x_2 - 2x_3 = 3$$

[5]

5. Find the initial B.F.S and cost of the following transportation problem by North West corner method :

	D1	D2	D3	D4	Availability
O1	5	3	6	2	19
O2	4	7	9	1	37
O3	3	7	4	5	34
Demand	16	18	31	25	

[5]

6. Distinguish Between Transportation Problem and Assignment Problem.

[5]

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following :

7. (a) A small manufacturer is making two products A and B. Two resources R1 and R2 are required to make these products. Each unit of product A requires 1 unit of R1 and 3 units of R2. Each unit of product B requires 1 unit of R1 and 2 units of R2. The manufacturer has 5 units of R1 and 12 units of R2 available. The manufacturer also makes a profit of Rs. 6 per unit of product A when sold and Rs. 5 per unit of product B when sold.

(i) Give a mathematical formulation to this linear programming problem for maximizing the profit.
(ii) Use graphical method to solve this problem.

[5+5]

(b) Solve the two person zero sum game

	Player B		
Player A		B1	B2
	A1	3	-2
	A2	1	2

[5]

8. (a) Find out the dual of the following problem:

Maximize $z = 2x_1 + 3x_2 - 4x_3$

subject to $3x_1 + x_2 + x_3 \le 2$

$-4x_1 + 3x_3 \ge 4$

$x_1 - 5x_2 + x_3 = 5$

$x_1, x_2 \ge 0$ and x_3 is unrestricted

[7]

(b) Find the optimal solution and the corresponding cost of transportation of the following transportation problem

	D1	D2	D3	D4	Supply
O1	4	6	8	8	40
O2	6	8	6	7	60
O3	5	7	6	8	50
Demand	20	30	50	50	

[8]

9. (a) The Head of the department has five jobs A, B, C, D, E and five sub-ordinates V, W, X, Y, and Z. The number of hours each sub-ordinates would take to perform each job is as follows:

	V	W	X	Y	Z
A	3	5	10	15	8
B	4	7	15	18	8
C	8	12	20	20	12
D	5	5	8	10	6
E	10	10	15	25	10

How would the jobs be allocated to minimize the total time? [8]

(b) Solve the following L.P.P by simplex method:

$$\text{Maximize } z = 4x_1 + 7x_2$$
$$\text{subject to } 2x_1 + x_2 \le 1000$$
$$10x_1 + 10x_2 \le 6000$$
$$2x_1 + 4x_2 \le 2000$$
$$x_1, x_2 \ge 0$$

[7]

10. (a) Solve the following L.P.P by Big M method :

$$\text{Maximize } z = 2x_1 + 9x_2 + x_3$$
$$\text{Subject to } x_1 + 4x_2 + 2x_3 \ge 5$$
$$3x_1 + x_2 + 2x_3 \ge 4$$
$$x_1, x_2, x_3 \ge 0$$

[8]

(b) Prove that $x_1 = 2,\ x_2 = 1,\ x_3 = 1$ is a feasible solution of the system of equations

$$x_1 + 4x_2 - x_3 = 5$$
$$2x_1 + 3x_2 + x_3 = 8$$

Reduce the F.S to two different B.F.S. [7]

11. (a) For the game with pay off matrix:

	Player B	
Player A	B1	B2
A1	1	-3
A2	3	5
A3	-1	6
A4	4	1
A5	2	2
A6	-5	0

Determine the optimal strategies for player A and B using graphical method. Also determine the value of the game. [7]

(b) A project consists of 8 activities. The activity completion time and the precedence relationships are as follows :

Activity	A	B	C	D	E	F	G	H
Completion time(day)	5	7	6	3	4	2	6	5
Predecessor activities	-	-	-	A	B,C	C	A,D	E,F

(i) Draw the network diagram.
(ii) Calculate the minimum overall project completion time and identify which activities are critical.
(iii) If the activity E is delayed by 3 day, how is the project completion time affected?
(iv) If the activity F is delayed by 3 day, how is the project completion time affected?

[4+2+1+1]