BRAINWARE UNIVERSITY

Course – BCA

Mathematics-III (BCA304)

(Semester – 3)

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 Questions)

10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) Which statement characterizes standard form of a linear programming problem?

a. Constraints are given by inequalities of any type
b. Constraints are given by a set of linear equations and in-equations
c. Constraints are given only by inequalities of '≥' type
d. Constraints are given only by inequalities of '≤' type

(ii) Which of the following statement is true comparing the transportation and assignment algorithms to the simplex algorithm?

a. similar computational effort, faster, and similar computer memory usage
b. less computational effort, similar speed, and less computer memory usage
c. less computational effort, faster, and similar computer memory usage
d. less computational effort, faster, and less computer memory usage

(iii) Maximize $z = 2x + 7y$ subject to

$3x - 2y \leq 1$

$-x + 3y \geq -1$

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) Consider two extreme points of a convex set: A(0,1,2) and B(3,4,5). Identify the point C which belongs to a line segment joining A and B.

a. C(3/2,5/2,7/2) b. C(1,2,4)

c. C(0,1,3) d. C(0,4,8)

(v) Operations Research (OR) , which is a very powerful tool for ----------

a. Research b. Decision – Making

c. Operations d. All of these

(vi) A non – degenerate basic feasible solution is the basic feasible solution which has exactly m positive X_i (i=1,2,...,m), i.e., none of the basic variable is ----------

a. Zero b. One

c. Two d. Infinite

(vii) Once the initial basic feasible solution has been computed, what is the next step in the transportation problem?

a. VAM b. Modified distribution method

c. Optimality test d. None of these

(viii) If there are 'm' origin and 'n' demand in Transportation problem, then there will be ------ no. of basic cells.

a. m + n b. m-n

c. m+n+1 d. m+n-1

(ix) Which is one of the fundamental combinatorial optimization problems?

a. Transportation problem b. Optimization Problem

c. Assignment problem d. None of these

(x) Dual of the dual is -------

a. Primal b. Alternative

c. Dual d. None of these

Group – B

(Short Answer Type Questions)

(Answer any *three* from the following)

3 x 5 = 15

2. (a) What is convex hull? [2]

(b) How does it differ from concave hull? Explain with proper example. [3]

3. Show that $X=\{x: |x| \leq 2\}$ is a convex set. [5]

4. Find the dual of the following:

Max $z = 2x_1+3x_2+x_3$

Subject to the constraint

$4x_1+ 3x_2+x_3 = 6$

$x_1+ 2x_2+5x_3 = 4$

for $x_1,x_2,x_3 \geq 0$ [5]

5. Solve graphically

Min $z = 4x_1+2x_2$

Subject to the constraint

$3x_1+ x_2 \geq 27$

$-x_1- x_2 \leq -21$

$x_1+ 2x_2 \geq 30$

for $x_1, x_2 \geq 0$

Find the corner points of the physical region and hence find the minimum value of the objective function. [5]

6. Find the optimal assignment for the following cost matrix:

	M_1	M_2	M_3	M_4
J_1	10	12	19	11
J_2	5	10	7	8
J_3	12	14	13	11
J_4	8	15	11	9

[5]

Group – C

(Long Answer Type Questions)

(Answer any *three* from the following)

3 x 15 = 45

7. (a) A wooden company make two types of doll. Each type-I sells for $27, uses $10 of raw materials and takes $14 of labor costs. Each type-II sells for $21, uses $9 of raw materials, and takes $10 of labor costs. Each type-I needs 2 hours finishing and 1 hour carpentry; each type-II needs 1 hour finishing and 1 hour carpentry. Raw materials are unlimited, but only 100 hours of finishing and 80 hours of carpentry are available each week. Demand for type-II is unlimited; but at most 40 type-I can be sold each week. Formulate the above problem as a linear programming problem. How many of each dolls should be made each week to maximize profits? (Solve the above problem graphical method) [5+4]

(b) Prove that half- space are convex set. [6]

8. (a) Apply simplex methods to find the optimal solution of the following LPP:

Max $z = 3x_1+2x_2$

Subject to the constraint

$4x_1+3x_2 \leq 12$

$4x_1+x_2 \leq 8$

$4x_1- x_2 \leq 8$

for $x_1, x_2 \geq 0$ [7]

(b) Find the optimal solution from the Transportation problem and also calculate the cost.

	D_1	D_2	D_3	D_4	Availability
O_1	2	3	11	7	6
O_2	1	0	6	1	1
O_3	5	8	15	9	10
Demand	7	5	3	2	

[8]

9. (a) Apply Charne'sBig-M method to find the optimal solution of the following LPP:

Min $z = 4x_1+3x_2+x_3$

Subject to the constraint

$x_1+2x_2+4x_3 \geq 12$

$3x_1+2x_2+x_3 \geq 8$

for $x_1,x_2,x_3 \geq 0$ [8]

(b) Find the optimal solution from the transportation problem and calculate the cost.

	D_1	D_2	D_3	Availability
O_1	5	1	7	10
O_2	6	4	6	80
O_3	3	2	5	15
Demands	75	20	50	

[7]

10. (a) What do you mean by degenerate solution? Find all the basic solution, BFS and degenerate solution of the system of equation:

$2x_1+ 6x_2+ 2x_3+ x_4 = 3$

$6x_1+ 4x_2+ 4x_3+ 6x_4 = 2$ [2+5]

(b) Solve the travelling salesman problem given by the following 5X5 matrices

	1	2	3	4	5
1	∞	7	6	8	4
2	7	∞	8	5	6
3	6	8	∞	9	7
4	8	5	9	∞	8
5	4	6	7	8	∞

[8]

11. (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? [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? [8]