BRAINWARE UNIVERSITY

Term End Examination 2022
Programme – BBA LL.B.-2019/BBA LL.B.-2020/BBA LL.B.-2021
Course Name – Quantitative Analysis
Course Code - BBALLB301
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[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) 1 x 15=15

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

(i) Consider the LP problem:
Maximize 5X1 + 8X2
subject to
3X1 + 4X2 ≤ 16
5X1+2X2≤12
X1, X2 ≥ 0

Write the corner point obtained by solving 3X1+4X2=16 and 5X1+2X2=12 as

a) (8/7, 22/7) b) (7/8, 22/7)
c) (8/7, 7/22) d) (7/8, 7/22)

(ii) Consider the LP problem
Maximize 3X1 + 8X2
subject to
3X1 + 5X2 ≤ 16
5X1 + 3X2 ≤ 12
X1, X2 ≥ 0

In the simplex algorithm, the variables that enters first is ___ and this variable replaces variable ____. Choose the answer to fill the blank.

a) X1, X3 b) X2, X1
c) X2, X3 d) X2, X4

(iii) An investor has Rs 20 lakhs with her and considers three schemes to invest the money for one year.The expected returns are 10%, 12% and 15% for the three schemes per year. The third scheme accepts only up to 10 lakhs. The investor wants to invest more money in scheme 1 than in scheme 2.The investor assesses the risk associated with the three

schemes as 0 units, 10 units and 20 units per lakh invested and does not want her risk to exceed 500 units. Calculate, how many decision variables are in your formulation?

a) 1
b) 2
c) 3
d) 4

(iv) Calculate the maximum profit for the following 3 x 3 assignment problem as

1	1	4
6	7	2
8	4	3

a) 15
b) 18
c) 19
d) 23

(v) Consider the following balanced TP with 2 supplies and 3 destinations. The solution is found using NWC rule. Calculate the cost as

5	6	3	50
7	5	8	40
30	25	35	

a) 570
b) 575
c) 580
d) 595

(vi) Observe, which of the following statements about the northwest corner rule is false:

a) One must exhaust the supply for each row before moving down to the next row
b) One must exhaust the demand requirements of each column before moving to the next column
c) When moving to a new row or column, one must select the cell with the lowest cost.
d) One must check that all supply and demand constraints are met.

(vii) In transportation model analysis the stepping-stone method is associated to

a) obtain an initial optimum solution
b) obtain an initial feasible solution
c) evaluate empty cells for potential solution improvements
d) evaluate empty cells for possible degeneracy

(viii) Interpret: the total cost of the optimal solution to a transportation problem

a) is calculated by multiplying the total supply (including any dummy values) by the average cost of the cells
b) cannot be calculated from the information given
c) can be calculated from the original non-optimal cost, by adding the savings made at each improvement
d) can be calculated based only on the entries in the filled cells of the solution

(ix) Consider the 3 job 4 machine assignment problem:

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

Choose, the objective function value at the optimum as

a) 9
b) 10
c) 11
d) 12

(x) A food stall sells idlis, dosas and poories. A plate of idli has 2 pieces, a plate of dosa has 1 piece while a plate of poori has 2 pieces. They also sell a "combo" which has 2 idlis and 2 poories. A kg of batter costs Rs 60 and contains twelve spoons of batter. Each piece of idli requires 1 spoon of batter and each dosa requires 1.5 spoons of batter. Each poori piece requires 1 ball of wheat dough and a kg of wheat dough that costs Rs 60 can make 20 balls of dough. The selling prices of the items are Rs 40,

60, 60 and 90 per plate respectively. The owner has Rs 800 with her and estimates the demand for the four items (in plates) as 50, 30, 20 and 10 respectively. There is a penalty cost of Rs 10 for any unmet plate of demand of an item. Idli being the most commonly consumed item, the owner wishes to meet at least 80% of the demand. Formulate an LP problem and answer the following questions: Calculate, how many constraints are in the formulation

a) 3 b) 4
c) 5 d) 6

(xi) Consider the maximum flow problem with n nodes and m arcs. You are writing a formulation with f as the maximum flow. Write the total number of variables

a) m+1 b) n+1
c) m+n+1 d) m.n+1

(xii) Select the term with which Game theory is concerned:

a) predicting the results of bets placed on games like roulette. b) the choice of an optimal strategy in conflict situations.
c) utility maximization by firms in perfectly competitive markets. d) the migration patterns of caribou in Alaska

(xiii) Tell, which of the following statements are not true of simulation?

a) A simulation model cannot prescribe what should be done about a problem. b) the equation describing the operating characteristics of the system are known.
c) simulation model can be used to study alternative solutions to a problem. d) Simulation models the behavior of a system.

(xiv) Consider the LP problem:

Maximize 7X1 + 6X2
subject to
X1 + X2 ≤ 4
2X1 + X2 ≤ 6
X1,X2 ≥ 0

Write the objective function corresponding to the optimum solution as

a) 24 b) 26
c) 28 d) 30

(xv) Game theory is concerned with

a) predicting the results of bets placed on games like roulette. b) the choice of an optimal strategy in conflict situations.
c) utility maximization by firms in perfectly competitive markets. d) the migration patterns of caribou in Alaska.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Discuss all the basic solutions of the following equations identifying in each case the basic vectors and the basic variables. Also identify the degenerate solution if any: (3)

$3x_1 + x_2 - x_3 = 3$
$2x_1 + 3x_2 + x_3 = 2$ Â

OR

(3)

Prove that (2,1,3) is a feasible solution of the set of equations

$4x_1 + 2x_2 - 3x_3 = 1$

$6x_1 + 4x_2 - 5x_3 = 1$

Represent it to a basic feasible solution of the set of equations.

3. Using Graphical method solve the following L.P.P (3)

$Max\ z = 4x_1 + 3x_2$

Subject to

$2x_1 + 3x_2 \leq 8$

$3x_1 + 2x_2 \leq 12$

$x_1, x_2 \geq 0$ Â

OR

(3)

Solve the following linear programming problem by graphical method.

Max Z =100x + 100y.

Sub to: 10x + 5y ≤80

6x + 6y ≤66

4x + 8y ≥24

5x + 6y ≤90

x, y ≥0

4. Construct a network for a project whose activities and their predecessor relationship are given in the following table (3)

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Predecessor	-	A	B	A	D	C, E	D	D	H	H	F, H	G, J

OR

(3)

Construct a network for a project whose activities and their predecessor relationship are given in the following table

Activity	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	-	-	A	B	B	C	D	E	H, I	F, G

5. (3)

Consider the TP. You are given the allocations $X_{11} = 20$, $X_{13} = 30$, $X_{21} = 10$, $X_{22} = 25$ and $X_{23} = 5$.

5	6	3	50
7	5	8	40
30	25	35	

Test the above solution is optimum or not, if not then reduce to the corresponding optimum solution.

OR

Deduce the maximum profit for the following 4x 3 assignment problem is (3)

1	1	4
6	7	2
8	4	3
6	3	7

Â

6. Solve the 2x2 person zero sum game (3)

		Player B	
		B1	B2
Player A	A1	2	3
	A2	4	-1

OR

Justify, for what value of λ , the game with the following payoff matrix is strictly determinable? (3)

(i)

	B		
A	λ	6	2
	-1	λ	-7
	-2	4	λ

(ii)

	B		
A	λ	7	3
	-2	λ	-8
	-3	4	λ

Group-C

(Long Answer Type Questions) 5 x 6=30

7. (5)

Consider the TP. You are given the allocations $X_{11} = 20$, $X_{13} = 30$, $X_{21} = 10$, $X_{22} = 25$ and $X_{23} = 5$.

5	6	3	50
7	5	8	40
30	25	35	

Test the above solution is optimum or not, if not then reduce to the corresponding optimum solution.

OR

Deduce the maximum profit for the following 4x 3 assignment problem is (3)

1	1	4
6	7	2
8	4	3
6	3	7

Â

6. Solve the 2x2 person zero sum game (3)

		Player B	
		B1	B2
Player A	A1	2	3
	A2	4	-1

OR

Justify, for what value of λ , the game with the following payoff matrix is strictly determinable? (3)

(i)

	B		
A	λ	6	2
	-1	λ	-7
	-2	4	λ

(ii)

	B		
A	λ	7	3
	-2	λ	-8
	-3	4	λ

Group-C

(Long Answer Type Questions) 5 x 6=30

7. (5)

Apply simplex methods to evaluate the optimal solution of the following L.P.P

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

Subject to the constraint

$2x_1 + x_2 + x_3 \leq 2$

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

$2x_1 + 2x_2 + x_3 \leq 6$

for $x_1, x_2, x_3 \geq 0$

8. Identify the optimal solution and the corresponding cost of transportation in the following transportation problem (5)

	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	

9. Determine the dual of the following problem: (5)

Maximize $z = 3x_1 + x_2 + 2x_3 - x_4$

Subject to

$2x_1 - x_2 + 3x_3 + x_4 = 1$

$x_1 + x_2 - x_3 + x_4 = 3$

$x_1, x_2 \geq 0$ *and* x_3, x_4 are unrestricted in sign. Show further that the dual of the dual problem is primal.

OR

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-ordinate would take to perform each job is as follows: (5)

	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

Describe the process by which the jobs be allocated to minimize the total time?

10. (5)

12. For the game with pay off matrix: (5)

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

Evaluate the Optimal strategies for player A and B using graphical method. Also determine the values of the game.

OR

Decide the solution of the game using Dominance method whose pay off matrix is given by (5)

		B			
		B1	B2	B3	B4
A	A1	2	1	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

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