BRAINWARE UNIVERSITY

Term End Examination 2020 - 21

Programme – Bachelor of Business Administration & Bachelor of Law

Course Name – Quantitative Analysis

Course Code - BBALLB301

Semester / Year - Semester III

Time allotted : 75 Minutes Full Marks : 60

[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 60=60

1. *(Answer any Sixty)*

(i) A shop can make two types of sweets (A and B). They use two resources – flour and sugar. To make one packet of A, they need 2 kg of flour and 5 kg of sugar. To make one packet of B, they need 3 kg of flour and 3 kg of sugar. They have 25 kg of flour and 28 kg of sugar. These sweets are sold at Rs 800 and 900 per packet respectively. Find the best product mix The number of decision variables is _____

a) 1 b) 2

c) 3 d) 4

(ii) A company makes two products (A and B) and both require processing on 2 machines. Product A takes 10 and 15 minutes on the two machines per unit and product B takes 22 and 18 minutes per unit on the two machines. Both the machines are available for 2640 minutes per week. The products are sold for Rs 200 and Rs 175 respectively per unit. Formulate a LP to maximize revenue? The market can take a maximum of 150 units of product . An appropriate objective function for this problem is to

a) Maximize total revenue b) Minimize total cost

c) Maximize the total units of products produced. d) None of these

(iii) A company makes two products (A and B) and both require processing on 2 machines. Product A takes 10 and 15 minutes on the two machines per unit and product B takes 22 and 18 minutes per unit on the two machines. Both the

machines are available for 2640 minutes per week. The products are sold for Rs 200 and Rs 175 respectively per unit. Formulate a LP to maximize revenue? The market can take a maximum of 150 units of product . The number of constraints including sign restriction is _____

a) 1 b) 2

c) 4 d) 5

(iv) 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. How many decision variables are in your formulation?

a) 1 b) 2

c) 3 d) 4

(v) 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. How many greater than or equal to constraints are in your formulation. (To answer this question you should write your constraints such that the right hand side value is non negative)

a) 1 b) 2

c) 3 d) 4

(vi) TV sets are to be transported from three factories to three retail stores. The available quantities are 300, 400 and 500 respectively in the three factories and the requirements are 250, 350 and 500 in the three stores. They are first transported from the factories to warehouses and then sent to the retail stores. There are two warehouses and their capacities are 600 and 700 units. The unit

costs of transportation from the factories to warehouses and from the warehouses to retail stores are known. Formulate an LP and answer the following questions: The number of constraints in the formulation is

a) 6
b) 8
c) 10
d) 12

(vii) Thousand answer papers have to be totaled in four hours. There are 10 regular teachers, 5 staff and 4 retired teachers who can do the job. Regular teachers can total 20 papers in an hour; staff can do 15 per hour while retired teachers can do 18 per hour. The regular teachers total the papers correctly 98% of the times while this number is 94% and 96% for staff and retired teachers. We have to use the services of at least one staff. You can assume that any person can work for a fraction of an hour also. Formulate a relevant LP problem and answer the following questions. A relevant objective function would be to

a) Maximize the papers totaled by all of them in four hours
b) Minimize the papers totaled by staff and retired teachers
c) Minimize the number of papers correctly totaled by all of them
d) Minimize the number of papers incorrectly totaled by all of them

(viii) Thousand answer papers have to be totaled in four hours. There are 10 regular teachers, 5 staff and 4 retired teachers who can do the job. Regular teachers can total 20 papers in an hour; staff can do 15 per hour while retired teachers can do 18 per hour. The regular teachers total the papers correctly 98% of the times while this number is 94% and 96% for staff and retired teachers. We have to use the services of at least one staff. You can assume that any person can work for a fraction of an hour also. Formulate a relevant LP problem and answer the following questions. The number of constraints in the formulation is

a) 5
b) 10
c) 19
d) 20

(ix) A person is in the business of buying and selling items. He has 10 units in stock and plans for the next three periods. He can buy the item at the rate of Rs

50, 55 and 58 at the beginning of periods 1, 2 and 3 and can sell them at Rs 60, 64 and 66 at the end of the three periods. He can use the money earned by selling at the end of the period to buy items at the beginning of the next period. He can buy a maximum of 200 per period. He can borrow money at the rate of 2% per period at the beginning of each period. He can borrow a maximum of Rs 8000 per period and he cannot borrow more than Rs 20000 in total. He has to pay back all the loans with interest at the end of the third period. How many decision variables are in the formulation

a) 3
b) 6
c) 9
d) 10

(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: What is the most suitable objective function for this problem?

a) Maximize the total money earned by sale
b) Maximize the total money earned by sale less the cost of items bought
c) Maximize the total plates made of all the items
d) Minimize the unmet demand

(xi) Consider the napkins problem where the requirement is for 20 days. There are two types of laundries – fast and slow. The fast laundry takes 2 days (napkins sent at the end of day 1 can be used on day 3) and the slow laundry takes 3 days (napkins sent at the end of day 1 can be used on day 4).The costs of the new napkins and the two laundries are known. The objective function has _____ terms

a) 54 b) 55

c) 56 d) 57

(xii) Consider the napkins problem where the requirement is for 20 days. There are two types of laundries – fast and slow. The fast laundry takes 2 days (napkins sent at the end of day 1 can be used on day 3) and the slow laundry takes 3 days (napkins sent at the end of day 1 can be used on day 4).The costs of the new napkins and the two laundries are known. The total number of constraints relating to the laundries is _____

a) 12 b) 14

c) 16 d) 18

(xiii) Consider the media selection problem with n possible things to invest in. Examples could be TV, radio, newspaper etc. There is a total budget restriction and limit on investment in each. The objective function has _____ terms

a) n b) n+1

c) n+2 d) n-1

(xiv) Consider the media selection problem with n possible things to invest in. Examples could be TV, radio, newspaper etc. There is a total budget restriction and limit on investment in each. The number of constraints is _____

a) n b) n+1

c) n+2 d) n+3

(xv) Consider the LP problem: Maximize 5X1 + 8X2 subject to 3X1 + 4X2 ? 12 5X1 + 2X2 ?20 X1, X2 ? 0. The objective function corresponding to the optimum solution is _____

a) 24 b) 26

c) 30 d) 36

(xvi) A constraint that does not affect the feasible region is a

a) non-negativity constraint b) slack constraint

c) redundant constraint
d) standard constraint

(xvii) Consider the LP problem: Maximize 5X1 + 8X2 subject to 2X1 + 3X2 ? 8 2X1 + 3X2 ? -1 X1, X2 ? 0. The corner point that gives the optimum solution is

a) (0,8/3)
b) (8/3,0)
c) (0,3/8)
d) (3/8,0)

(xviii) Consider the LP problem: Maximize 5X1 + 8X2 subject to 2X1 + 3X2 ? 8 2X1 + 3X2 ? -1 X1, X2 ? 0. Which of the following is true

a) The LP is unbounded
b) The LP is infeasible
c) The corner point (0,0) is optimum
d) The corner point (4,0) is optimum

(xix) Consider the LP problem: Minimize 2X1 - 3X2 subject to X1 + X2 ? 4 2X1 + X2 ? 2 X1 +2X2 ? 6 X1, X2 ? 0. The objective function value at optimum is ____

a) -7
b) -9
c) 7
d) 9

(xx) Consider the LP problem: Maximize 7X1 + 6X2 subject to X1 + X2 ? 4 2X1 + X2 ? 6 X1, X2 ? 0. Solve by algebraic method and answer the following: The number of basic feasible solutions is _____

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

(xxi) Consider the LP problem: Maximize 7X1 + 6X2 subject to X1 + X2 ? 4 2X1 + X2 ? 6 X1, X2 ? 0. Solve by algebraic method and answer the following: If we solve for X2 and X3 as basic and the other variables as non-basic, the value of X3 is _____

a) 0
b) 2
c) -2
d) 1

(xxii) Consider the LP problem: Maximize 7X1 + 6X2 + 4X3 subject to X1 + X2 + X3 ? 5 2X1 + X2 + 3X3? 10 X1, X2, X3 ? 0. Solve by algebraic method and answer the following: The number of basic infeasible solutions is _____

a) 1 b) 2

c) 3 d) 4

(xxiii) Consider the LP problem: Maximize 7X1 + 6X2 + 4X3 subject to X1 + X2 + X3 ? 5 2X1 + X2 + 3X3? 10 X1, X2, X3 ? 0. Solve by algebraic method and answer the following: The number of unique basic feasible solutions is _____

a) 3 b) 4

c) 5 d) 6

(xxiv) Consider the LP problem: Maximize 7X1 + 6X2 + 4X3 subject to X1 + X2 + X3 ? 5 2X1 + X2 + 3X3? 10 X1, X2, X3 ? 0. Solve by algebraic method and answer the following: The value of the objective function at optimum is _____

a) 30 b) 33

c) 34 d) 35

(xxv) Consider the LP problem: Minimize 6X1 + 5X2 subject to X1 + X2 ? 3 2X1 + X2 ? 5 X1, X2 ? 0. Solve by algebraic method and answer the following : The number of basic feasible solutions is _____

a) 1 b) 3

c) 4 d) 5

(xxvi) Consider the LP problem Minimize 3X1 + 8X2 + 3X3 +7X4 subject to 3X1 + 5X2 + X3 ? 16; 5X1 + 3X2 – X4 ? 12, X1, X2, X3, X4 ? 0. The number of artificial variables required to initialize the simplex table is ___

a) 1 b) 2

c) 3 d) 4

(xxvii) 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 ____

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

(xxviii) Consider the LP problem: Maximize 7X1 + 6X2 subject to X1 + X2 ? 4 2X1 + X2 ? 6 X1, X2 ?0. Solve using the algebraic form of the simplex algorithm and answer the following: At the end of the first iteration, the objective function coefficient for X2 is ____

a) 2.5
b) 3
c) 3.5
d) 4

(xxix) Consider the LP problem: Maximize 7X1 + 6X2 subject to X1 + X2 ? 4 2X1 + X2 ? 6 X1, X2 ?0. Solve using the algebraic form of the simplex algorithm and answer the following: At the optimum, the coefficient of variable X3 in the objective function is _____

a) 2
b) 5
c) -5
d) -2

(xxx) Solve the LP problem Maximize 3X1 + 8X2 subject to 3X1 + 5X2 ? 16 5X1 + 3X2 ? 12 X1, X2? 0 Using the simplex algorithm. The optimum solution has X2 = _____

a) 3.1
b) 3.2
c) 3.3
d) 3.4

(xxxi) Solve the LP problem Maximize 4X1 + 3X2 + 5X3 subject to X1 + X2 + X3 ? 10 2X1 + X2 + 3X3 ?20 3X1 + 2X2 + 4X3 ? 30 X1, X2, X3 ? 0 using the simplex algorithm and answer the following questions. If you have a tie to decide a leaving variable, break the tie arbitrarily. How many iterations, after the initial table did you take to reach the optimum

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

(xxxii) Solve the LP problem Maximize 4X1 + 3X2 + 5X3 subject to X1 + X2 + X3 ? 10 2X1 + X2 + 3X3 ?20 3X1 + 2X2 + 4X3 ? 30 X1, X2, X3 ? 0 using the simplex algorithm and answer the following questions. If you have a tie to decide a leaving variable, break the tie arbitrarily. How many Cj – Zj values are zero at the optimum

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

(xxxiii) Solve the LP problem Maximize 9X1 + 3X2 + 5X3 subject to 4X1 + X2 + X3 ? 12 2X1 + 4X2 + 3X3? 22 5X1 + 2X2 + 4X3 ? 34 X1, X2, X3 ? 0 using the simplex algorithm and answer the following questions. The number of iterations taken by simplex (after the initial table) to reach the optimum is _____

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

(xxxiv) Solve the LP problem using Simplex algorithm Minimize 9X1 + 3X2 subject to 4X1 + X2 ? 12 7X1 + 4X2 ? 16 X1, X2 ? 0 using the simplex algorithm. Which of the following is the correct answer

a) The optimum solution is (0, 4)
b) The problem is unbounded
c) The problem is infeasible with simplex showing artificial variable a1 = 20/7 at optimum
d) The problem is infeasible with simplex showing artificial variable a1 = 3 at optimum

(xxxv) Solve the LP problem using Simplex algorithm Minimize X1 - X2 subject to X1 + X2 ? 7 X1 ? 10 X1, X2 ? 0 using the simplex algorithm. Which of the following is TRUE

a) The problem is infeasible
b) The problem is unbounded
c) X1 = 7 is the optimum solution
d) X2 = 0 is optimum

(xxxvi) If a primal constraint is an equation, the corresponding dual variable is

a) bounded
b) unbounded
c) unrestricted
d) none of these

(xxxvii) If the kth variable in a minimization (primal) is ? 0, the kth constraint in the dual is an inequality of the ___ type

a) ?
b) ?
c) =
d) Can't be said.

(xxxviii) If the primal (maximization) has an objective function value of 100 at the optimum, which of the following is TRUE

a) Dual has an objective function value greater than 100 at optimum
b) Dual has an objective function value lesser than 100 at optimum
c) Dual has an objective function value equal to 100 at optimum
d) Dual's objective function value at optimum does not depend on the objective function value of the primal

(xxxix) Given the LP problem Maximize 3X1 + 5X2 + 9X3 subject to X1 + X2 + 2X3 ? 6 2X1 + 3X2 + X3 ?8 X1, X2, X3 ? 0 The dual has _____ variables

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

(xl) Write the LP dual to the problem. Minimize 2X1 + 3X2 subject to X1 + X2 ? 4 2X1 +4X2 ? 10 X1, X2 ? 0. The shadow price of the first resource is_____

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

(xli) Consider the LP Maximize 2X1 + 3X2 + 4X3 + X4 subject to X1+ 2X2 +5X3 + X4 ? 12. Xj ? 0. Solve the dual and find the optimum solution to the primal. The value of the objective function at the optimum is ____

a) 18
b) 20
c) 22
d) 24

(xlii) Consider the LP Maximize 2X1 + 3X2 + 4X3 + X4 subject to X1+ 2X2

+5X3 + X4 ? 12. Xj ? 0. Solve the dual and find the optimum solution to the primal. If 100 units of the resource are available, the value of the objective function at optimum is _____

a) 120
b) 180
c) 200
d) 240

(xliii) Consider the LP problem: Maximize 5X1 + 12X2 subject to 2X1 + 5X2 ? 13 7X1 + 11X2 ? 31 X1, X2 ? 0. Solve this problem using Simplex algorithm and answer the following: Which of the following is NOT TRUE

a) This solution is not optimum because a variable can enter the basis and increase the objective function further
b) The solution is not optimum because the corresponding dual solution after applying complimentary slackness conditions is infeasible
c) The variable y1 is in the solution when the dual is solved after applying complimentary slackness
d) The variable y2 is in the solution when the dual is solved after applying complimentary slackness

(xliv) Consider a two variable LP problem with a minimization objective function and three constraints all of the ? type. The first constraint cuts the X1 and X2 axes at 2 and 7 respectively. The second constraint cuts the two axes at 3 and 5 respectively and the third constraint at 4 and 4 respectively. The objective function is 3X1 + 2X2. The optimum solution to the primal is

a) (4, 0)
b) (0, 7)
c) (12/11, 35/11)
d) (3/2, 5/2)

(xlv) Consider a transportation problem with 3 supply points and 4 demand points. The number of constraints in the formulation is

a) 3
b) 6
c) 7
d) 10

(xlvi) If ui and vj represent the dual variables in the assignment formulation, the constraint set is given by

a) ui + vj = Cij
b) ui + vj ? Cij

c) ui + vj ? Cij

d) None of these

(xlvii) The purpose of the transportation approach for locational analysis is to minimize

a) total costs

b) total shipping costs

c) total variable costs

d) total fixed costs

(xlviii) 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.

(xlix) A transportation problem has a feasible solution when

a) all of the improvement indexes are positive

b) all the squares are used

c) the solution yields the lowest possible cost

d) all demand and supply constraints are satisfied

(l) 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

(li) In a minimization problem, a negative improvement index in a cell indicates that the

a) solution is optimal

b) total cost will increase if units are

reallocated to that cell

c) total cost will decrease if units are reallocated to that cell

d) current iteration is worse than the previous one

(lii) An improvement index indicates

a) whether a method other than the stepping stone should be used

b) whether a method other that the northwest corner rule should be used

c) whether the transportation cost in the upper left-hand corner of a cell is optimal

d) how much total cost would increase or decrease if a single unit was reallocated to that cell

(liii) How many feasible solutions does a 5 x 5 assignment problem have?

a) 5!

b) 4!

c) 6!

d) 3!

(liv) How many constraints does a 5 x 5 assignment problem have?

a) 8

b) 10

c) 12

d) 15

(lv) How many constraints does the dual of the 5 x 5 assignment problem have?

a) 15

b) 20

c) 25

d) 30

(lvi) In a PERT network, the starting vertex is a

a) burst node

b) merge node

c) root

d) none of these.

(lvii) The activity that can be delayed without affecting the execution of the immediate succeeding activity is determined by

a) total float

b) free float

c) independent float

d) none of these

(lviii) Point out what is not required, While considering precedence relationships

a) All the predecessor(s) of an activity should be focussed on.

b) Only immediate predecessor(s) should be focussed on.

c) Redundant predecessors should be dropped.

d) Care must be taken that there is no logical fault in it as may result in formation of a loop.

(lix) It is known that in a project, an activity 4-6 has duration of six days and total float of three days. The E and L times at node 4 and 8 and 11 respectively while, at node 6, both are equal to 17. Which of the following is not a true statement about 4-6?

a) Its free float is three days.

b) Its independent float is 0

c) It is a critical activity.

d) The ES of this activity is 8..

(lx) In game theory, a situation in which one firm can gain only what another firm loses is called a

a) nonzero-sum game.

b) prisoners' dilemma.

c) zero-sum game.

d) cartel temptation.