BRAINWARE UNIVERSITY

Term End Examination 2021 - 22
Programme – Master of Science in Mathematics
Course Name – Operations Research
Course Code - MSCMC401
(Semester IV)

Time allotted : 1 Hrs.15 Min. **Full Marks : 60**

[The figure in the margin indicates full marks.]

Group-A

(Multiple Choice Type Question) 1 x 60=60

Choose the correct alternative from the following :

(1) 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.
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

(2) 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

(3) 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 decision variables is ______________

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

(4) 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 is ___________________

a) 1
b) 2
c) 4
d) 5

(5) 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 constraints are in your formulation?

a) 2
b) 3
c) 4
d) 5

(6) Two tasks have to be completed and require 10 hours and 12 hours of work if one person does the tasks. If n people do task 1, the time to complete the task becomes 10/n and so on. Similarly if n people do task 2, the time becomes 12/n and so on. We have 5 people and they have to be assigned to the two tasks. We cannot assign more than three to task 1. Find the earliest time that both tasks are completed if they start at the same time. (Use ideas from the bicycle problem to write your objective function. At some point you may have to define a variable to represent the reciprocal of another variable).
Formulate an LP problem and answer the following:
The final objective function is

a) Maximization problem with one term in the objective function
b) Minimization problem with one term in the objective function
c) Maximization problem with two terms in the objective function
d) Minimization problem with two terms in the objective function

(7) Two tasks have to be completed and require 10 hours and 12 hours of work if one person does the tasks. If n people do task 1, the time to complete the task becomes 10/n and so on. Similarly if n people do task 2, the time becomes 12/n and so on. We have 5 people and they have to be assigned to the two tasks. We cannot assign more than three to task 1. Find the earliest time that both tasks are completed if they start at the same time. (Use ideas from the bicycle problem to write your objective function. At some point you may have to define a variable to represent the reciprocal of another variable).
Formulate an LP problem and answer the following:
The total number of constraints in the final formulation is

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

(8) 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 objective function

a) Maximizes the total cost of transportation between factories and warehouses and between warehouses and retail stores

b) Maximizes the total quantity transported between factories and warehouses and between warehouses and retail stores

c) Minimizes the total cost of transportation between factories and warehouses and between warehouses and retail stores

d) Minimizes the total quantity transported between factories and warehouses and between warehouses and retail stores

(9) 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 terms in the objective function is

a) 6
b) 8
c) 12
d) 18

(10) 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 decision variables in the formulation is

a) 8
b) 10
c) 12
d) 18

(11) 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

(12) 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 decision variables in an efficient formulation is

a) 3

b) 4

c) 9

d) 19

(13)

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.

What is the correct objective function for this problem?

a) Maximize the total money available at the end of the third period

b) Maximize the total money at the end of the third period less total money borrowed

c) Maximize the total money at the end of the third period less total money paid back including interest

d) Maximize the number of items sold at the end of the third period

(14)

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

(15)

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:

How many decision variables are in the formulation

a) 3

b) 4

c) 5

d) 8

(16) 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:

How many constraints are in the formulation

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

(17) Consider the maximum flow problem with n nodes and m arcs. You are writing a formulation with f as the maximum flow.

The total number of constraints is ____________

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

(18) 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

(19) 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 variables in the formulation is ___________

a) 58
b) 57
c) 55
d) 53

(20) 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 constraint to meet the demand of day 10 will have ___________ terms

a) 20
b) 25
c) 30
d) 35

(21) 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

(22) 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 decision variables is ___________

a) n-1
b) n-2
c) n
d) n+1

(23) Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to
$X_1 + X_2 \leq 4$
$2X_1 + X_2 \leq 6$
$X_1, X_2 \geq 0$
The objective function corresponding to the optimum solution is.............

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

(24) Consider the LP problem:
Maximize $5X_1 + 8X_2$
subject to
$3X_1 + 4X_2 \leq 12$
$5X_1 + 2X_2 \leq 20$
$X_1, X_2 \geq 0$.
The objective function corresponding to the optimum solution is ________

a) 24
b) 26
c) 30
d) 36

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

a) non-negativity constraint
b) slack constraint
c) redundant constraint
d) standard constraint

(26) Consider the LP problem:
Maximize $5X_1 + 8X_2$
subject to
$2X_1 + 3X_2 \leq 8$
$2X_1 + 3X_2 \geq -1$
$X_1, X_2 \geq 0$.
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)

(27) Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to $X_1 \leq 4$
$X_1 - X_2 \geq 0$
$X_1, X_2 \geq 0$
The objective function corresponding to the optimum solution is ________

a) 48 b) 49
c) 51 d) 52

(28) Consider the LP problem:
Minimize $5X_1 + 8X_2$
subject to
$X_1 + X_2 \leq 6$
$X_1 + X_2 \geq 2$
$X_1 - X_2 \leq 2$
$X_1 - X_2 \geq -2$
$X_1, X_2 \geq 0$.
The objective function value at optimum is _____

a) 6 b) 7
c) 8 d) 10

(29) Consider the LP problem:
Minimize $2X_1 - 3X_2$
subject to
$X_1 + X_2 \leq 4$
$2X_1 + X_2 \geq 2$
$X_1 + 2X_2 \leq 6$
$X_1, X_2 \geq 0$.
The objective function value at optimum is _____

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

(30) Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to $X_1 + X_2 \leq 4$
$2X_1 + X_2 \leq 6$
$X_1, X_2 \geq 0$.
Solve by algebraic method and answer the following:

The number of basic feasible solutions is ________

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

(31) Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to $X_1 + X_2 \leq 4$
$2X_1 + X_2 \leq 6$
$X_1, X_2 \geq 0$.
Solve by algebraic method and answer the following:

If we solve for X_1 and X_3 as basic and the other variables as non-basic, the value of X_2 is ____________

a) 0
b) 1
c) 2
d) 4

(32)
Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to $X_1 + X_2 \leq 4$
$2X_1 + X_2 \leq 6$
$X_1, X_2 \geq 0$.
Solve by algebraic method and answer the following:

If we solve for X_2 and X_3 as basic and the other variables as non-basic, the value of X_3 is ___________

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

(33)
Consider the LP problem:
Maximize $7X_1 + 6X_2 + 4X_3$
subject to
$X_1 + X_2 + X_3 \leq 5$
$2X_1 + X_2 + 3X_3 \leq 10$
$X_1, X_2, X_3 \geq 0$.
Solve by algebraic method and answer the following:

The number of basic solutions is ________

a) 8
b) 9
c) 10
d) 11

(34)
Consider the LP problem:
Maximize $7X_1 + 6X_2 + 4X_3$
subject to
$X_1 + X_2 + X_3 \leq 5$
$2X_1 + X_2 + 3X_3 \leq 10$
$X_1, X_2, X_3 \geq 0$.
Solve by algebraic method and answer the following:

If we solve for X_2 and X_3 as basic and the other variables as non-basic, the value of X_3 is ___________

a) 1.5
b) 1.9
c) 2.4
d) 2.5

(35)
Consider the LP problem:
Maximize $7X_1 + 6X_2 + 4X_3$
subject to
$X_1 + X_2 + X_3 \leq 5$
$2X_1 + X_2 + 3X_3 \leq 10$
$X_1, X_2, X_3 \geq 0$.
Solve by algebraic method and answer the following:

The number of unique basic feasible solutions is ___________

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

(36)

Consider the LP problem:
Maximize $7X_1 + 6X_2 + 4X_3$
subject to
$X_1 + X_2 + X_3 \leq 5$
$2X_1 + X_2 + 3X_3 \leq 10$
$X_1, X_2, X_3 \geq 0.$
Solve by algebraic method and answer the following:

The optimum solution has $X_1 =$ ________

a) 2 b) 5
c) 6 d) 8

(37)

Consider the LP problem:
Minimize $6X_1 + 5X_2$
subject to
$X_1 + X_2 \geq 3$
$2X_1 + X_2 \geq 5$
$X_1, X_2 \geq 0.$
Solve by algebraic method and answer the following :
The number of basic solutions is ________

a) 2 b) 4
c) 6 d) 8

(38)

Consider the LP problem:
Minimize $6X_1 + 5X_2$
subject to
$X_1 + X_2 \geq 3$
$2X_1 + X_2 \geq 5$
$X_1, X_2 \geq 0.$
Solve by algebraic method and answer the following :

The number of basic feasible solutions is ________

a) 1 b) 3
c) 4 d) 5

(39)

Consider the LP problem:
Minimize $6X_1 + 5X_2$
subject to
$X_1 + X_2 \geq 3$
$2X_1 + X_2 \geq 5$
$X_1, X_2 \geq 0.$
Solve by algebraic method and answer the following :

The optimum solution has $X_1 =$ _______

a) 0 b) 1
c) 1.5 d) 2

(40)

Consider the LP problem:

Minimize $6X_1 + 5X_2$

subject to

$X_1 + X_2 \geq 3$

$2X_1 + X_2 \geq 5$

$X_1, X_2 \geq 0.$

Solve by algebraic method and answer the following :

The value of objective function at optimum is _________

a) 17 b) 18

c) 27 d) 28

(41)

Consider the LP problem

Minimize $3X_1 + 8X_2 + 3X_3 + 7X_4$

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) 4

(42)

Consider the LP problem

Minimize $3X_1 + 8X_2$

subject to

$3X_1 + 5X_2 \geq 16$

$5X_1 + 3X_2 \geq 12$

$X_1, X_2 \geq 0.$

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

a) 1 b) 2

c) 3 d) 4

(43)

Consider the LP problem

Maximize $3X_1 + 8X_2$

subject to

$3X_1 + 5X_2 \leq 16$

$5X_1 + 3X_2 \leq 12$

$X_1, X_2 \geq 0$

In the simplex algorithm, the variables that enters first is ____ and this variable replaces variable _____

a) X_1, X_3 b) X_2, X_1

c) X_2, X_3 d) X_2, X_4

(44)

Consider the LP problem:

Maximize $7X_1 + 6X_2$

subject to

$X_1 + X_2 \leq 4$

$2X_1 + X_2 \leq 6$

$X_1, X_2 \geq 0.$

Solve using the algebraic form of the simplex algorithm and answer the following:

a) 2.5
b) 3.0
c) 3.5
d) 4.0

(45)

Consider the LP problem:
Maximize $7X_1 + 6X_2$
subject to
$X_1 + X_2 \leq 4$
$2X_1 + X_2 \leq 6$
$X_1, X_2 \geq 0$.
Solve using the algebraic form of the simplex algorithm and answer the following:

When X_2 enters the solution, the value it takes is _______

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

(46)

Solve the LP problem
Maximize $3X_1 + 8X_2$
subject to
$3X_1 + 5X_2 \leq 16$
$5X_1 + 3X_2 \leq 12$
$X_1, X_2 \geq 0$
Using the simplex algorithm.

The optimum solution has $X_2 =$ ______

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

(47)

Solve the LP problem
Maximize $4X_1 + 3X_2 + 5X_3$
subject to
$X_1 + X_2 + X_3 \leq 10$
$2X_1 + X_2 + 3X_3 \leq 20$
$3X_1 + 2X_2 + 4X_3 \leq 30$
$X_1, X_2, X_3 \geq 0$ 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 variables are there in the initial Simplex table

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

(48)

Solve the LP problem
Maximize $4X_1 + 3X_2 + 5X_3$
subject to
$X_1 + X_2 + X_3 \leq 10$
$2X_1 + X_2 + 3X_3 \leq 20$
$3X_1 + 2X_2 + 4X_3 \leq 30$
$X_1, X_2, X_3 \geq 0$ 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 basic variables have a positive value at the optimum

a) 1 b) 2

c) 3 d) 5

(49)

Solve the LP problem

Maximize $4X_1 + 3X_2 + 5X_3$

subject to

$X_1 + X_2 + X_3 \leq 10$

$2X_1 + X_2 + 3X_3 \leq 20$

$3X_1 + 2X_2 + 4X_3 \leq 30$

$X_1, X_2, X_3 \geq 0$ 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 $C_j - Z_j$ values are zero at the optimum

a) 1 b) 2

c) 3 d) 4

(50)

Solve the LP problem

Maximize $9X_1 + 3X_2 + 5X_3$

subject to

$4X_1 + X_2 + X_3 \leq 12$

$2X_1 + 4X_2 + 3X_3 \leq 22$

$5X_1 + 2X_2 + 4X_3 \leq 34$

$X_1, X_2, X_3 \geq 0$ 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

(51)

Solve the LP problem

Maximize $9X_1 + 3X_2 + 5X_3$

subject to

$4X_1 + X_2 + X_3 \leq 12$

$2X_1 + 4X_2 + 3X_3 \leq 22$

$5X_1 + 2X_2 + 4X_3 \leq 34$

$X_1, X_2, X_3 \geq 0$ using the simplex algorithm and answer the following questions.

The set of basic variables at the optimum is

a) $X_1 X_2 X_6$ b) $X_1 X_3 X_5$

c) $X_1 X_3 X_6$ d) $X_2 X_3 X_6$

(52)

Solve the LP problem using Simplex algorithm

Minimize $2X_1 + 3X_2$

subject to

$X_1 + X_2 \geq 4$

$X_1 \leq 1$

$X_1, X_2 \geq 0$ using the simplex algorithm.

If we add the constraint $2X_1 + 3X_2 \leq 11$

The value of the objective function at the optimum is ______

a) 7 b) 9

c) 10 d) 11

(53) Solve the LP problem using Simplex algorithm
Minimize $2X_1 + 3X_2$
subject to
$X_1 + X_2 \geq 4$
$X_1 \leq 1$
$X_1, X_2 \geq 0$ using the simplex algorithm.
If we add the constraint $2X_1 + 3X_2 \leq 11$

The value of X_2 at the optimum is _____

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

(54) Solve the LP problem using Simplex algorithm
Minimize $2X_1 + 3X_2$
subject to $X_1 + X_2 \geq 4$
$2X_1+4X_2 \geq 10$
$X_1, X_2 \geq 0$ using the simplex algorithm.

The value of the objective function at the optimum is _____

a) 5
b) 7
c) 9
d) 11

(55) Solve the LP problem using Simplex algorithm
Minimize $2X_1 + 3X_2$
subject to $X_1 + X_2 \geq 4$
$2X_1+4X_2 \geq 10$
$X_1, X_2 \geq 0$ using the simplex algorithm.

The value of X_2 at the optimum is ____

a) 0
b) 1
c) 2
d) 4

(56) Solve the LP problem using Simplex algorithm
Minimize $X_1 - X_2$
subject to $X_1 + X_2 \geq 7$
$X_1 \leq 10$
$X_1, X_2 \geq 0$ using the simplex algorithm.
Which of the following is TRUE

a) The problem is infeasible
b) The problem is unbounded
c) $X_1 = 7$ is the optimum solution
d) $X_2 = 0$ is optimum

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

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

(58) Every feasible solution to the dual (minimization problem) has an objective function greater than or equal to that of every feasible solution to the primal. This theorem is called the

a) Weak duality theorem

b) Optimality criterion theorem

c) Main duality theorem

d) Complimentary slackness theorem

(59) In the optimum solution, if a primal constraint is satisfied as an equation, the value of the corresponding dual variable is ____

a) Positive

b) Negative

c) Zero

d) Can't be said.

(60) If the k^{th} variable in a minimization (primal) is ≥ 0, the k^{th} constraint in the dual is an inequality of the ____ type

a) $\geq$

b) $\leq$

c) $=$

d) Can't be said.