Math 210

1. Minimize $C = 5x - 7y$ subject to the constraints:

$$\begin{aligned} 2x + y &\leq 12 \\ x, y &\geq 0 \end{aligned}$$

The minimum is:

(a) -84.

(b) 75.

(c) -75.

(d) 84.

(e) None of the above.

2. How many vertices has the region described by:

$$\begin{aligned} x &\geq 0 \\ y &\geq 0 \\ x &\leq 4 \\ y &\leq 4 \\ x + y &\leq 8 \end{aligned}$$

(a) 3

(b) 4

(c) 5

(d) 6

(e) 2

3. Which of the following is **not** an example of a linear objective function?

(a) $C = 2x_1 + 3x_2 + 5x_3$

(b) $P = x - 3y + 5z$

(c) $C = -2u + 3v - 5w$

(d) $P = 3x + 5x^2 + 7x^3$

(e) $P = 3x + 5y + 7z$

4. A jeweler makes rings, earrings and necklaces. He wishes to work no more than 40 hours a week. It takes him 2 hours to make a ring, 2 hours to make a pair of earrings and 4 hours to make a necklace. He wants to make no more pieces of each type of jewelry than he can sell in a week. He estimates that he can sell no more than 10 rings, 10 pairs of earrings and 3 necklaces per week. The jeweler charges \$50 for a ring, \$80 for a pair of earrings and \$200 for a necklace.

   How many rings must the jeweler sell per week to maximize his earnings?

   (a) 4

   (b) 3

   (c) 2

   (d) 1

   (e) None of the above.

5. Maximize $C = 3x - 7y$ subject to the constraints:

$$\begin{aligned} x - 2y &\leq -18 \\ x + 2y &\leq 24 \\ 2x + 3y &\leq 48 \\ x, y &\geq 0 \end{aligned}$$

   The optimal solution is:

   (a) $x = 6,\ y = 2.$

   (b) $x = 0,\ y = 9.$

   (c) $x = 0,\ y = 0.$

   (d) $x = 12,\ y = 0.$

   (e) None of the above.

6. MrJones has \$9000 to invest in three types of stocks: low-risk, medium risk, and high-risk. He invests according to three principles. The amount invested in low-risk stocks will be at most \$1000 more than the amount invested in medium-risk stocks. At least \$5000 will be invested in low- and medium risk stocks. No more than \$7000 will be invested in medium- and high-risk stocks. The expected yields are 6% for low-risk stocks, 7% for medium-risk stocks, and 8% for high-risk stocks. If x is the amount of money MrJones invests in low-risk stocks and y is the amount of money he invests in medium-risk stocks, what is the objective function for his total yield, which he wants to maximize?

(a) $720 - .02x - .01y$

(b) $720 - .06x - .07y$

(c) $9000 - .06x - .07y$

(d) $720 - .94x - .93y$

(e) None of the above

7. Given the simplex tableau for a standard maximization problem:

x	y	s_1	s_2	s_3	P	
0	1	0	1	0	0	4
1	0	-1	1	0	0	2
0	0	1	-2	1	0	2
0	0	-1	4	0	1	14

Which is true?

(a) There are two basic variables: s_1 and s_2.

(b) The final solution has $x = 4,\ y = 4$, and $P = 16$.

(c) The final solution has $x = 4, y = 2$, and $P = 14$.

(d) The pivot element is in the 4th column.

(e) The pivot element is in the second row.

8. Maximize $M = 2x - y - 7z$ subject to:

$$\begin{aligned} x, y, z &\geq 0 \\ -4x - 3y - 2z &\geq -12 \end{aligned}$$

The maximum of M is:

(a) 6

(b) 8

(c) 4

(d) 1

(e) 2

9. Which of the following statements are true.

I. A primal problem has a solution if and only if the corresponding dual problem has a solution.

II. If a solution exists, then the objective functions of both the primal and the dual problem attain the same value.

III. If a solution exists, then the optimal solution to the dual problem corresponding to the standard maximization problem appears under the slack variables in the last row of the final simplex tableau.

(a) III only

(b) all three

(c) I and II only

(d) I only

(e) II only

10. Which of the following linear programming problems are in standard form as maximization problems?

$$I. \text{ Maximize } \quad P = 7x - 5y \text{ subject to } \begin{cases} -3x + 5y & \leq & -15 \\ 4x + 8y & \leq & 30 \\ x, y & \geq & 0 \end{cases}$$

$$II. \text{ Maximize } \quad P = 2x + 5y \text{ subject to } \begin{cases} x + 4y & \leq & 20 \\ 6x - 3y & \leq & 60 \\ x, y & \geq & 0 \end{cases}$$

$$III. \text{ Maximize } \quad P = 7x - 5y \text{ subject to } \begin{cases} -3x + 5y & \geq & 15 \\ 4x + 8y & \leq & 30 \\ x, y & \geq & 0 \end{cases}$$

(a) III only

(b) II only

(c) I only

(d) II and III only

(e) Some other selection.

11. Maximize $P = 2x + 10y + 6z$ subject to the constraints:

$$\begin{array}{rcr} x + 2y & \leq & 10 \\ y + 3z & \leq & 24 \\ x, y, z & \geq & 0 \end{array}$$

The maximum is:

(a) 50.

(b) 88.

(c) 10.

(d) 48.

(e) 70.

12. Maximize $C = 6x - 14y + 2z$ subject to the constraints:

$$\begin{aligned} x - 2y + 3z &\leq 18 \\ -x + 2y + z &\leq -6 \\ x, y, z &\geq 0 \end{aligned}$$

The optimal solution is:

(a) $x = 0,\ y = 0,\ z = 9.$

(b) $x = 0,\ y = 0,\ z = 6.$

(c) $x = 6,\ y = 0,\ z = 0.$

(d) $x = 9,\ y = 0,\ z = 0.$

(e) $x = 18,\ y = 0,\ z = 0.$

13. A farmer has 100 acres of land on which to grow tomatoes and peas. The cost of planting each acre of tomatoes is \$ 50. Each acre of peas will cost \$ 25 to plant. The farmer's budget for planting is \$ 6250. If the anticipated profits are \$ 100 per acre of peas and
\$ 150 per acre of tomatoes, how many acres of each should be planted to maximize profits?

If x denotes the number of acres of tomatoes to be planted and y the number of acres of peas, then the profit to be maximized is:

(a) $P = 25x + 50y.$

(b) $P = 150x + 100y.$

(c) $P = 50x + 25y.$

(d) $P = 100x + 6250y.$

(e) $P = 100x + 150y.$

14. Maximize $P = x + 9y + 6z$ subject to the constraints:

$$\begin{aligned} 4x + 5z &\leq 210 \\ x + y + z &\leq 48 \\ x &\leq 45 \\ x, y, z &\geq 0 \end{aligned}$$

The maximum is:

(a) 764.

(b) 676.

(c) 345.

(d) 875.

(e) 432.

15. Minimize $C = 3x + 2y + z$ subject to

$$\begin{cases} 2x + 3y - z \geq 6 \\ 2x + y \geq 4 \\ x, y, z \geq 0 \end{cases}$$

The minimum value of C is:

(a) 13/2

(b) -4

(c) $-13/2$

(d) 4

(e) None of the above.

16. Find the value of the pivot element in the following simplex tableau:

$$\left(\begin{array}{cccccccc|c} 1 & 0 & -1 & 1 & 0 & 0 & 1 & 0 & 1 \\ -3 & 0 & 2 & 0 & 1 & 0 & 2 & 0 & -4 \\ 4 & 1 & 0 & 0 & 0 & 0 & -3 & 0 & 1 \\ -2 & 0 & 3 & 0 & 0 & 1 & -6 & 0 & 5 \\ \hline 2 & 0 & -3 & 0 & 0 & 0 & 2 & 1 & 4 \end{array}\right)$$

(a) 2

(b) -3

(c) 4

(d) 3

(e) -1

17. Consider the system of inequalities:

$$\begin{aligned} x + y &\leq 150 \\ 2x + y &\leq 200 \\ x &\geq 10 \\ y &\geq 20 \end{aligned}$$

Which of the following are vertices of the feasible set?

(a) $(0, 0)$.

(b) $(130, 20)$.

(c) $(50, 100)$.

(d) $(10, 180)$.

(e) None of the above.

18. A company produces two models of fax machines: a Value and a Deluxe. Each Value model costs \$200 to make while each Deluxe costs \$300 to make.The profits are \$25 for each Value model and \$40 for each Deluxe. The total number of fax machines demanded per month does not exceed 2500 and the company has a budget of \$600,000 for manufacturing costs. How many units of each model should the company produce in order to maximize its profits? Suppose that x Value models and y Deluxe models are produced per month.

Which of the following is one of the constraints?

(a) $25x + 40y \leq 2500$

(b) $25x + 40y \leq 600,000$

(c) $200x + 300y \leq 2500$

(d) $x + y \geq 2500$

(e) None of the above.

19. A chemical plant has two ways to manufacture a chemical. The old process emits 4 g of sulfur dioxide and 2 g of particulate matter into the atmosphere for each gallon of the chemical produced. The new process emits 1 g of sulfur dioxide and 1 g of particulate matter into the atmosphere for each gallon of the chemical produced. The company makes a profit of \$3 per gallon using the old process and \$1 per gallon with the new process. Government regulations restrict emissions to at most 2300 g of sulfur dioxide per day and at most 1500 g of particulate matter per day. What is the maximum daily profit?

(a) \$ 1500

(b) \$ 1750

(c) \$ 1800

(d) \$ 1900

(e) None of the above

20. Consider the simplex tableau

$$\left(\begin{array}{cccccc|c} x & y & u & v & w & P & \\ 5 & 0 & 12 & 0 & 1 & 0 & 14 \\ 3 & 0 & 6 & 1 & 0 & 0 & 12 \\ 8 & 1 & 7 & 0 & 0 & 0 & 5 \\ \hline 3 & 0 & 4 & 0 & 0 & 1 & 26 \end{array}\right)$$

The optimal solution for x, y, P is:

(a) $x = 14, y = 12, P = 26$

(b) $x = 0, y = 5, P = 26$

(c) $x = 14, y = 12, P = 0$

(d) $x = 3, y = 0, P = 0$

(e) None of the above.

21. Maximize $C = 6x - 14y + 2z$ subject to the constraints:

$$\begin{aligned} x - 2y + 3z &\leq 18 \\ -x + 2y + z &\leq -6 \\ x, y, z &\geq 0 \end{aligned}$$

The maximum is:

(a) -126.

(b) -36.

(c) 36.

(d) -108.

(e) None of the above.

22. A chemical plant has two ways to manufacture a chemical. The old process emits 4 g of sulfur dioxide and 2 g of particulate matter into the atmosphere for each gallon of the chemical produced. The new process emits 1 g of sulfur dioxide and 1 g of particulate matter into the atmosphere for each gallon of the chemical produced. The company makes a profit of \$3 per gallon using the old process and \$1 per gallon with the new process. Government regulations restrict emissions to at most 2300 g of sulfur dioxide per day and at most 1500 g of particulate matter per day. How many gallons should be produced by the new process to achieve the maximum daily profit?

(a) 600

(b) 400

(c) 500

(d) 700

(e) None of the above

23. Solve the dual problem

Minimize $C = 40u + 12v + 40w$ subject to

$$\begin{aligned} 2u + v + 5w &\geq 20 \\ 4u + v + w &\geq 30 \\ u, v, w &\geq 0 \end{aligned}$$

Final tableau:

x	y	s_1	s_2	s_3	P	
0	1	1/2	−1	0	0	8
1	0	−1/2	2	0	0	4
0	0	2	−9	1	0	12
0	0	5	10	0	1	320

In the **dual** solution

(a) $v = 5$

(b) $u = 0$

(c) $w = 0$

(d) $y = 0$

(e) $x = 4$

24. Maximize $C = 3x - 7y$ subject to the constraints:

$$\begin{aligned} x - 2y &\leq -18 \\ x + 2y &\leq 24 \\ 2x + 3y &\leq 48 \\ x, y &\geq 0 \end{aligned}$$

The maximum is:

(a) 63.

(b) 4.

(c) -63.

(d) 36.

(e) None of the above.

25. Maximize $P = 2x + 10y + 6z$ subject to the constraints:

$$\begin{aligned} x + 2y &\le 10 \\ y + 3z &\le 24 \\ x, y, z &\ge 0 \end{aligned}$$

The optimal solution is:

(a) $x = 0,\ y = 19/3,\ z = 5.$

(b) $x = 5,\ y = 19/3,\ z = 0.$

(c) $x = 0,\ y = 5,\ z = 19/3.$

(d) $x = 19/3,\ y = 0,\ z = 5.$

(e) $x = 44,\ y = 0,\ z = 0.$

26. Minimize $C = x - 5y + 5z$ subject to the constraints:

$$\begin{aligned} x + 3y - 3z &\le 15 \\ 2y - z &\le 10 \\ x, y, z &\ge 0 \end{aligned}$$

The minimum is:

(a) -15.

(b) 10.

(c) -25.

(d) 25.

(e) 5.

27. How many vertices has the region described by?

$$\begin{aligned} x &\ge 0 \\ y &\ge 0 \\ x &\le 4 \\ y &\le 4 \\ x + y &\ge 5 \end{aligned}$$

(a) 5

(b) 2

(c) 1

(d) 4

(e) 3

28. Minimize $C = 6x + 4y + 2z$ subject to the constraints:

$$\begin{aligned} x + 2y - 5z &\geq 15 \\ x, y, z &\geq 0 \end{aligned}$$

The minimum is:

(a) 50.

(b) 30.

(c) 10.

(d) 15.

(e) 5.

29. Find the value of the pivot element in the following simplex tableau:

$$\left(\begin{array}{cccccccc|c} 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 5 & 3 & 1 & 0 & 0 & 0 & 2 & 0 & 2 \\ 7 & -2 & 0 & 0 & 1 & 0 & -3 & 0 & 2 \\ 4 & 4 & 0 & 0 & 0 & 1 & -6 & 0 & 3 \\ \hline -50 & -10 & 0 & 0 & 0 & 0 & 2 & 1 & 4 \end{array}\right)$$

(a) 3

(b) 4

(c) 5

(d) 1

(e) None of the above.

30. A manufacturer produces chairs, tables, and desks. Each product needs carpentry and finishing. A chair needs an hour of carpentry and two hours of finishing. A table needs 2 hours of carpentry and 2 hours of finishing. Desks need 4 hours of carptentry and 3 hours of finishing. There are 240 hours of carpentry and 320 hours of finishing available. He also wants to make at least as many chairs as tables and desks combined. The manufacturer wishes to maximize profits of $20 per chair, $40 per table, and $50 per desk.

Which of the following is one of the constraints?

I. $20x + 40y + 50z \leq 320$ II. $x + 2y + 4z \geq 240$ III. $x - y - z \geq 0$

(a) all three

(b) II only

(c) II, III

(d) I, III

(e) None of the above

31. Minimize $M = 5x + 4y - 3z$ subject to:

$$\begin{aligned} x, y, z &\geq 0 \\ -2x - 3y + 3z &\leq 6. \end{aligned}$$

The minimum of M is:

(a) 3

(b) 6

(c) -3

(d) -6

(e) 2

32. Which of the following is *not* a corner point of the region:

$$\begin{cases} 2x+y & \leq & 25 \\ x+y & \leq & 20 \\ x & \leq & 12 \\ x,y & \geq & 0 \end{cases}$$

(a) (12,1)

(b) (12,0)

(c) (0,0)

(d) (5,15)

(e) (0,25)

33. Pivot on the underlined entry 3 in row 1, column 2, in the following tableau:

$$\begin{bmatrix} x & y & u & v & M & \\ 2 & \underline{3} & 1 & 0 & 0 & 12 \\ 1 & 1 & 0 & 1 & 0 & 10 \\ -10 & -20 & 0 & 0 & 1 & 0 \end{bmatrix}$$

Which of the following statements are true of the new tableau?

I. Another pivot is necessary. II. The optimal value is 80.

(a) I only

(b) II only

(c) neither is true

(d) both are true

(e) None of the above

34. Solve the dual problem

Minimize $C = 2u + 3v$ subject to

$$\begin{aligned} u + 4v &\geq 8 \\ u + v &\geq 5 \\ 2u + v &\geq 7 \\ u, v &\geq 0 \end{aligned}$$

Final tableau:

x	y	z	s_1	s_2	P	
0	1	$*$	$*$	$*$	0	5/3
1	0	$*$	$*$	$*$	0	1/3
0	0	2	4	1	1	11

In the **dual** solution

(a) $y = 5/3$

(b) $v = 4$

(c) $u = 4$

(d) $z = 2$

(e) $x = 5/3$

35. Consider the system of inequalities:

$$\begin{aligned} x + y &\leq 150 \\ 2x + y &\leq 200 \\ x &\geq 10 \\ y &\geq 20 \end{aligned}$$

Maximize $P = 5x + 10y$ subject to the above constraints. The maximum is:

(a) 1850.

(b) 1250.

(c) 850.

(d) 650.

(e) 1450.

36. Minimize $C = 5x + 7y - z$ subject to the constraints:

$$\begin{aligned} 2x + y + z &\leq 12 \\ x, y, z &\geq 0 \end{aligned}$$

The optimal solution is:

(a) $x = 5,\ y = 7,\ z = 0.$

(b) $x = 0,\ y = 0,\ z = 24.$

(c) $x = 7,\ y = 8,\ z = 0.$

(d) $x = 0,\ y = 0,\ z = 12.$

(e) None of the above.

37. A company produces two models of fax machines: a Value and a Deluxe. Each Value model costs \$200 to make while each Deluxe costs \$300 to make.The profits are \$25 for each Value model and \$40 for each Deluxe. The total number of fax machines demanded per month does not exceed 2500 and the company has a budget of \$600,000 for manufacturing costs. How many units of each model should the company produce in order to maximize its profits? Suppose that x Value models and y Deluxe models are produced per month.

The maximum profit is :

(a) \$77,500

(b) \$75,000

(c) \$80,000

(d) \$17,000

(e) None of the above.

38. Maximize $M = 2x - y - z$ subject to:

$$\begin{aligned} x, y, z &\geq 0 \\ -4x - y - z &\geq -8 \end{aligned}$$

The maximum of M is

(a) 1

(b) 2

(c) 4

(d) 8

(e) 16

39. Which statement is **true** regarding linear programming problems?

(a) The minimum value of the objective function, if it exists, will occur at a corner point of the feasible set.

(b) If the maximum of an objective function P occurs at (x, y) then the minimum of $M = -P$ occurs at $(-x, -y)$.

(c) When solving a problem by graphing, the feasible set has at most five corner points.

(d) It is impossible for the maximum value of an objective function to occur at two different corner points of the feasible set.

(e) Any objective function always has a maximum.

40. Read the *current* solution (x, y, z) from the following tableau:

x	y	z	s_1	s_2	s_3	P	
0	1	0	1	1	1	0	4
0	0	1	−2	0	0	0	8
1	1	0	4	1	0	0	3
0	0	0	−3	−6	0	1	20

(a) $(4, 8, 3)$

(b) $(3, 4, 8)$

(c) $(3, 0, 8)$

(d) $(3, 3, 8)$

(e) None of the above.

41. A jeweler makes rings, earrings and necklaces. He wishes to work no more than 40 hours a week. It takes him 2 hours to make a ring, 2 hours to make a pair of earrings and 4 hours to make a necklace. He wants to make no more pieces of each type of jewelry than he can sell in a week. He estimates that he can sell no more than 10 rings, 10 pairs of earrings and 3 necklaces per week. The jeweler charges $50 for a ring, $80 for a pair of earrings and $200 for a necklace.

What is the jewelers maximum weekly earnings?

(a) $1800

(b) $1000

(c) $700

(d) $1600

(e) $1500

42. Find the value of the pivot element in the following simplex tableau:

$$\left[\begin{array}{rrrrrrrr|r} 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 5 & 10 & 1 & 0 & 0 & 0 & 2 & 0 & 3 \\ 7 & 2 & 0 & 0 & 1 & 0 & -3 & 0 & 2 \\ 4 & 5 & 0 & 0 & 0 & 1 & -6 & 0 & -2 \\ \hline -5 & -10 & 0 & 0 & 0 & 0 & 2 & 1 & 4 \end{array}\right]$$

(a) 2

(b) 4

(c) -3

(d) 1

(e) None of the above

43. Maximize $P = -2x - 3y + 5z$ subject to the constraints:

$$\begin{aligned} 2x + y + 2z &\leq 12 \\ x - y - 3z &\leq 8 \\ x, y, z &\geq 0 \end{aligned}$$

The maximum is:

(a) -15.

(b) 15.

(c) -30.

(d) 30.

(e) None of the above.

44. Find the value of the pivot element in the following simplex tableau:

$$\left[\begin{array}{rrrrrrrr|r} 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 5 & 10 & 1 & 0 & 0 & 0 & 2 & 0 & 3 \\ 7 & 2 & 0 & 0 & 1 & 0 & -3 & 0 & 2 \\ 4 & 5 & 0 & 0 & 0 & 1 & -6 & 0 & 5 \\ \hline -5 & -10 & 0 & 0 & 0 & 0 & 2 & 1 & 4 \end{array}\right]$$

(a) -3

(b) 2

(c) 4

(d) 1

(e) None of the above

45. Consider the problem

$$\text{Maximize} \quad P = 7x - 5y + 11z \text{ subject to } \begin{cases} -3x + 5y + 4z & \leq & 25 \\ 4x + 8y + 8z & \leq & 30 \\ x + 2y + 7z & \leq & 10 \\ 2x - y + 9z & \leq & 40 \\ x, y, z & \geq & 0 \end{cases}$$

How many slack variables does the Simplex method use when applied to this problem?

(a) 2

(b) 5

(c) 3

(d) 4

(e) 1

46. The function, $P = 7x + 8y$, is to be minimized over a triangular shaped region, whose corner points are $A = (2, 9)$, $B = (5, 11)$, and $C = (13, 1)$. What is the minimum value of P?

(a) 56

(b) 86

(c) 0

(d) 15

(e) None

47. Which of the following statements are true regarding a given Simplex tableau?

I. If there are negative numbers in the far right column (and above the bottom row), then the system is not in standard form.

II. If there are no negative values in the bottom row, then the problem is finished.

(a) neither is true

(b) both are true

(c) I only

(d) II only

(e) None of the above

48. Consider the simplex tableau

$$\left(\begin{array}{cccccc|c} x & y & u & v & w & P & \\ -5 & 0 & 12 & 0 & 1 & 0 & -14 \\ 3 & 0 & 6 & 1 & 0 & 0 & 12 \\ 8 & 1 & 7 & 0 & 0 & 0 & 5 \\ \hline 3 & 0 & 4 & 0 & 0 & 1 & 26 \end{array}\right)$$

Which is correct?

(a) The location of the next pivot is: row 2, column 1

(b) No further pivoting is necessary.

(c) The location of the next pivot is: row 1, column 1

(d) The location of the next pivot is: row 3, column 1

(e) Some other selection of pivot is required.

49. Maximize $P = 2x + 2y$ subject to the constraints:

$$\begin{aligned} x + y &\leq 18 \\ x, y &\geq 0 \end{aligned}$$

The maximum occurs for :

(a) $x = 0, y = 18$ ONLY.

(b) $x = 0, y = 0$.

(c) $x = 18, y = 18$ ONLY.

(d) $x = 0, y = 18$ AND $x = 18, y = 0$.

(e) $x = 18, y = 0$ ONLY.

50. Which of the following linear programming systems are in standard form:

I. Maximize $2x - 3y$	II. Minimize $2x + 3y$	III. Maximize $4x - y$
$-x + 2y \leq 6$	$x + 3y \geq 20$	$-x + y \leq 0$
$y \leq 4$	$6x - 2y \leq 30$	$2x + y \leq 8$
$x, y \geq 0$		$x, y \geq 0$

(a) all three

(b) I only

(c) II and III

(d) III only

(e) None of the above

51. Minimize $C = 5x + 7y - z$ subject to the constraints:

$$\begin{aligned} 2x + y + z &\leq 12 \\ x, y, z &\geq 0 \end{aligned}$$

The minimum is:

(a) -12.

(b) -24.

(c) 12.

(d) 24.

(e) None of the above.

52. Consider the following simplex tableau

$$\left(\begin{array}{ccccc|c} x & y & u & v & P & \\ 6 & 4 & 1 & 0 & 0 & 28 \\ 5 & 1 & 0 & 1 & 0 & 20 \\ \hline -20 & -32 & 0 & 0 & 1 & 0 \end{array}\right)$$

Which of the following statements are correct?

I] Further pivoting is necessary. II] The optimal value of P is 224.

(a) Both are true.

(b) I only.

(c) II only.

(d) Neither is true.

(e) Some other selection.

53. Find the value of the pivot element in the following simplex tableau:

x	y	s_1	s_2	s_3	s_4	P	
0	1	1	0	0	1	0	80
0	60	0	1	0	40	0	4600
0	25	0	0	1	20	0	1900
1	0	0	0	0	−1	0	70
0	−200	0	0	0	−150	1	320

(a) 25

(b) 60

(c) 1

(d) 20

(e) 40

54. Find the value of the pivot element in the following simplex tableau:

$$\left(\begin{array}{cccccccc|c} 1 & 0 & -1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 2 & 0 & 2 & 0 & 1 & 0 & -2 & 0 & -4 \\ 4 & 1 & 0 & 0 & 0 & 0 & -3 & 0 & 1 \\ -3 & 0 & 3 & 0 & 0 & 1 & -6 & 0 & 5 \\ \hline 6 & 0 & -3 & 0 & 0 & 0 & -2 & 1 & 4 \end{array}\right)$$

(a) -1.

(b) -2.

(c) 3.

(d) 1.

(e) 2.

55. How many vertices (corners) has the feasible set for:

$$\begin{aligned} x + 5y &\geq 10 \\ 5x - 4y &\leq 20 \\ x + y &\geq 4 \\ x &\leq 0 \\ y &\geq 0 \end{aligned}$$

(a) 2.

(b) 4.

(c) 1.

(d) 3.

(e) None of the above.

56. Consider the simplex tableau

$$\left(\begin{array}{rrrrrrr|r} x & y & z & u & v & w & P & \\ 0 & 2 & 0 & 6 & 1 & 3/2 & 0 & 44 \\ 0 & 1 & 1 & 2/3 & 0 & 2 & 0 & 8 \\ 1 & 5 & 0 & -2 & 0 & 1/3 & 0 & 10 \\ \hline 0 & -8 & 0 & -12 & 0 & 4 & 1 & 60 \end{array}\right)$$

The location of the next pivot is:

(a) row 3, column 2

(b) row 1, column 4

(c) row 1, column 2

(d) row 3, column 4

(e) None of the above.

57. Determine the location of the next pivot in the tableau:

$$\begin{bmatrix} x & y & z & u & v & w & M & \\ 0 & 0 & \frac{1}{2} & 1 & \frac{4}{3} & \frac{3}{2} & 0 & 12 \\ 0 & 1 & -\frac{2}{3} & 0 & 2 & 2 & 0 & 20 \\ 1 & 0 & 2 & 0 & 1 & \frac{1}{3} & 0 & 32 \\ 0 & 0 & -8 & 0 & -10 & 4 & 1 & 60 \end{bmatrix}$$

(a) row 1, col$\dot{3}$

(b) row 3, col$\dot{3}$

(c) row 2, col$\dot{5}$

(d) row 1, col$\dot{5}$

(e) None

58. Maximize $P = 2x + 6y$ subject to the constraints:

$$\begin{aligned} x + 3y &\leq 15 \\ x, y &\geq 0 \end{aligned}$$

The maximum occurs for :

(a) $x = 0, y = 5$ ONLY.

(b) $x = 15, y = 0$ ONLY.

(c) Along the line segment joining $x = 0, y = 5$ to $x = 15, y = 0$.

(d) $x = 20, y = 0$ ONLY.

(e) Some other value of x and y.

59. Read the *current* solution (x, y, z) from the following tableau:

$$\begin{bmatrix} x & y & z & u & v & w & M & \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 4 \\ 0 & 0 & 1 & -2 & 0 & 0 & 0 & 8 \\ 1 & 1 & 0 & 4 & 1 & 0 & 0 & 3 \\ 0 & 0 & 0 & -3 & -6 & 0 & 1 & 20 \end{bmatrix}$$

(a) $(3, 3, 8)$

(b) $(3, 0, 8)$

(c) $(4, 8, 3)$

(d) $(3, 4, 8)$

(e) None of the above

60. For a linear programming problem in two variables, the objective function is to be maximized. Which of the following situations are possible?

A. The maximum occurs at exactly one vertex of the feasible set.

B. The maximum occurs at exactly seven vertices of the feasible set.

C. The objective function does not have a maximum on the feasible set.

(a) A, B and C.

(b) A and B only.

(c) A only.

(d) A and C only.

(e) None of the above.

61. Which of the following is a corner point of the feasible set for the linear programming problem: Minimize the objective function $M = 8x + 6y$ subject to the constraints

$$\begin{aligned} 4x + 5y &\leq 200, \\ 6x + 3y &\leq 210, \\ x, y &\geq 0. \end{aligned}$$

(a) $(10, 40)$

(b) $(0, 70)$

(c) $(50, 0)$

(d) $(25, 20)$

(e) None of the above.

62. Which of the following statements are true regarding linear programming problems?

I. In order to use the Simplex method to minimize a function C, you must maximize $P = -C$.

II. The Simplex method does not allow any variable to be negative.

III. If the maximum of P occurs at (x, y), then the minimum of $C = -P$ occurs at $(-x, -y)$.

(a) II only

(b) all three are true

(c) I and II are true

(d) I only

(e) None

63. Maximize $P = -2x - 3y + 5z$ subject to the constraints:

$$\begin{aligned} 2x + y + 2z &\leq 12 \\ x - y - 3z &\leq 8 \\ x, y, z &\geq 0 \end{aligned}$$

The optimal solution is:

(a) $x = 0,\ y = 0,\ z = 6.$

(b) $x = 0,\ y = 0,\ z = -6.$

(c) $x = 0,\ y = 0,\ z = 3.$

(d) $x = 7,\ y = 11/2,\ z = 0.$

(e) None of the above.

64. Minimize $M = x + y - z$ subject to:

$$\begin{aligned} x, y, z &\geq 0 \\ -2x - 3y + 3z &\leq 6 \end{aligned}$$

The minimum of M is:

(a) -2

(b) 2

(c) 1

(d) 3

(e) -3

abdabababb - 10
bebeaccedb - 20
edccccebee - 30
debcedccac - 40
dddedbcdde - 50
aaadcbdcbd - 60
daaa