Unit 3 · Linear Programming

HARDER WORKSHEET

Full marks 26

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 26

1 Multiple choice [4]

Choose the correct option for each of the following questions.

i. Which system has **no** feasible region at all? [1]

a. $x + y \leq 3, x \geq 0, y \geq 0$ **b.** $x + y \leq 1, x + y \geq 3$

c. $x - y \geq 1, x + y \leq 1$ **d.** $x \geq 2, y \leq -2$

ii. The bakery's feasible region has vertices $O(0, 0)$, $A(8, 0)$, $B(6, 4)$ and $C(0, 10)$. How many whole-number plans (x, y) give the largest value of $Z = x + y$? [1]

a. 1 **b.** 2

c. 7 **d.** infinitely many

iii. Which constraint can be left out of $x + y \leq 4, x \leq 6, x \geq 0, y \geq 0$ without changing the feasible region? [1]

a. $x + y \leq 4$ **b.** $x \leq 6$

c. $x \geq 0$ **d.** $y \geq 0$

iv. A shaded region lies above the dashed line through $(0, -2)$ and $(3, 0)$. Which inequality is it? [1]

a. $2x - 3y \geq 6$ **b.** $2x - 3y > 6$

c. $2x - 3y < 6$ **d.** $3x - 2y < 6$

2 Short answers [8]

Write short answers to the following questions.

a. Work backwards. A triangle has vertices $A(1, 0)$, $B(5, 2)$ and $C(0, 4)$, its sides included. Write the three inequalities that describe it. [2]

b. Find the mistake. For $x + 2y \leq 8, x + y \leq 6, x \geq 0, y \geq 0$, Bibek lists the vertices as $O(0, 0)$, $(8, 0)$, $(4, 2)$ and $(0, 6)$. Which of his points are not vertices? Write the correct list. [2]

c. Is the report possible? A shop says Rupesh spent at most Rs 750 on pens at Rs 15 and copies at Rs 25, and bought 20 of each. Check, and find the most copies he could buy with 20 pens. **[2]**

d. Make your own. Write a system of linear inequalities whose feasible region is the square with corners (1, 1), (3, 1), (3, 3) and (1, 3), sides included. Then give the maximum of $Z = 2x - y$ on it. **[2]**

3 Long answers **[12]**

Solve the following problems. Show your working.

a. A furniture workshop in Bhaktapur makes chairs and tables. A chair takes 2 hours of carpentry and 1 hour of polishing, and earns Rs 1,500; a table takes 3 hours of carpentry and 1 hour of polishing, and earns Rs 2,500. In a week there are 24 hours of carpentry and 10 hours of polishing, and room for at most 6 tables. How many of each should it make for the most profit? (The numbers are made up for practice.) **[4]**

Answer:

b. The feasible region of $x + y \leq 5, 2x + y \leq 8, x \geq 0, y \geq 0$ is drawn. **[4]**

i. Find its vertices.

ii. For $Z = px + y$, find every value of p for which the maximum of Z is at the vertex (3, 2).



Answer: _____

c. Find the minimum value of $Z = 3x + 2y$ subject to $x + y \geq 5, x + 3y \geq 9, x \geq 0, y \geq 0$. Does Z have a maximum on this region? Explain. **[4]**



Answer: _____

4 Think [2]

Think, then answer.

A bakery's plan must use whole numbers of batches. The best corner of its feasible region is $(\frac{20}{3}, \frac{10}{3})$. Can the bakery just round it to $(7, 3)$? Explain what it should do instead.