# Extra Practice Exercises—Chapter 4

8. A designer is developing a rectangular tile. The perimeter of the tile must be at least 20 inches, but not more than 48 inches. The area of the tile must be at least 25 square inches.

   a) Develop a system of inequalities to represent the constraints in this problem.

   b) On a graph, indicate the region that represents the possible dimensions of the tile.
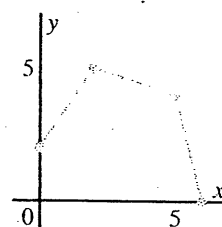
Tutorial 4.5 Optimization Problems

1. Find the optimal value for each objective function given its constraint polygon.

   a) $C = x + 3y$
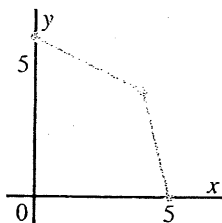
   b) $T = 4x + 2y$

2. Graph the system of inequalities:

   $x \geq 0$

   $y \geq 0$

   $2x + y \leq 6$

   $4x + y \leq 8$

   Determine the optimal values for the objective function $T = 3x + 4y$.

3. Graph the system of inequalities:

   $x \geq 0$

   $y \geq 0$

   $x + 3y \leq 6$

   $3x + y \leq 10$

   Determine the optimal values for the objective function $T = 2x + y$.

4. A small clothing company manufactures regular and deluxe shirts. Production and profit information is summarized in the table.

	Regular Shirts	Deluxe Shirts
Cutting Time (min)	20	40
Sewing Time (min)	30	20
Profit ($)	10	12

Available labour allows a maximum of 800 min of cutting time and 600 min of sewing time each day.

a) Define variables x and y for this problem.

b) Write a system of inequalities to represent the constraints.

c) Write the objective function for this problem.

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d) Graph the system of inequalities from part b to find the constraint polygon.

e) How many of each type of shirt should the company produce in a day to maximize its profits? What is the maximum profit?

5. A local craft shop produces copper bracelets and necklaces. Each bracelet requires 15 min of cutting time and 10 min of polishing time. Each necklace requires 15 min of cutting time and 20 min of polishing time. There are a maximum of 225 min of cutting time and 200 min of polishing time available each day. The shop makes a profit of $5 on each bracelet and $7 on each necklace sold.

a) Define variables and write a system of inequalities to represent the constraints.

b) Write the objective function.

c) Graph the constraint polygon.

d) How many necklaces and bracelets should the shop produce each day to maximize its profits? What is the maximum profit?

6. A test has two sections. Each question in Part I takes approximately 5 min to answer and is worth 4 marks. Each question in Part II takes approximately 10 min to answer and is worth 10 marks. Students have at most 1 h to complete the test and they must answer at least 7 questions.

a) Write a system of inequalities and the objective function for this problem.

b) Assume all questions are answered correctly. How many questions should a student answer from each section to obtain the maximum score?

7. A driver wants to maximize the distance travelled using at most 96 L of fuel. When the car travels at 100 km/h, it uses 12 L of gas per hour. When it travels at 90 km/h, it uses only 8 L of gas per hour. The total travelling time must not be more than 10 h.

a) Suppose x represents the number of hours spent travelling 100 km/h and y represents the number of hours spent travelling at 90 km/h. Write the system of inequalities that represent the constraints.

b) Write the objective function.

c) Use the constraint polygon and the objective function to determine the maximum distance the car can travel.

8. A driver wishes to travel as far as possible using at most 40 L of fuel. The car uses 10 L of gas per hour when it travels 80 km/h and 4 L of gas per hour when it travels 50 km/h. The total travelling time cannot be more than 8 h. What is the maximum distance the car can travel?

9. A cyclist plans to pack chocolate and raisins for energy. She has $3 to spend and thinks she will need at least 1000 calories. Chocolate has 5 calories per gram and costs $1.00 for 100 grams. Raisins have 3 calories per gram and cost $1.50 for 100 grams. What quantities of chocolate and raisins should she pack in order to minimize the weight?

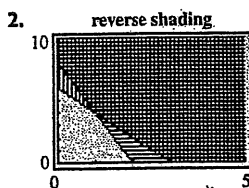# Extra Practice Exercises—Chapter 4

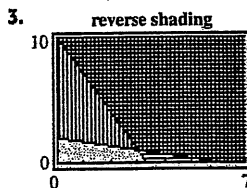**8. a)** $x > 0$; $y > 0$; $2x + 2y \geq 20$; $2x + 2y \leq 48$; $xy \geq 25$

b)
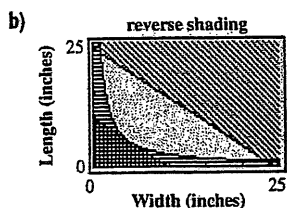
Tutorial 4.5

1. a) $(0, 6)$ **b)** $(5, 4)$

2.

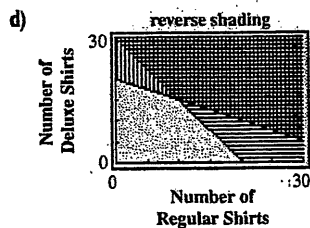Optimal values are $x = 0, y = 6$.

3.

Optimal values are $x = 3, y = 1$.

4. a) x: number of regular shirts produced; y: number of deluxe shirts produced

b) $20x + 40y \leq 800$; $30x + 20y \leq 600$; $x \geq 0$; $y \geq 0$

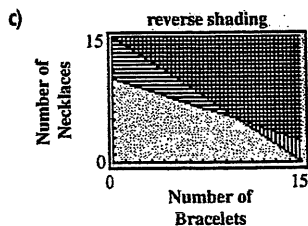**c)** $P = 10x + 12y$

d)

e) 10 regular shirts; 15 deluxe shirts; $280

5. a) x: number of bracelets; y: number of necklaces; $15x + 15y \leq 225$;
$10x + 20y \leq 200$; $x \geq 0$; $y \geq 0$

b) $P = 5x + 7y$

c)

d) 10 bracelets and 5 necklaces; $85