Work-out Problems

Study tip: Show all your work!

Exercise 1. Set up, but do NOT solve, a linear programming problem to solve the following:

Pyxie has at most \$20,000 to invest in three different stocks. The TWX company costs \$17.00 per share and pays dividends of \$.20 per share. The GE company costs \$34.00 per share and pays dividends of \$1.00 per share. The WMT company costs \$45.00 per share and pays \$.67 per share in dividends. Pyxie has given her broker the following instructions: Invest at least twice as much money in GE as in WMT. Also, no more than 25% of the total money invested should be in TWX. How should Pyxie invest her money to maximize the dividends?

Exercise 2. Consider the following linear programming problem:

$$\begin{aligned} \text{Objective : Minimize} \quad & C = 3x + 5y \\ \text{subject to} \quad & 4x + y \geq 36 \\ & 2x + y \geq 30 \\ & x + 3y \geq 30 \\ & x \geq 0,\ y \geq 0 \end{aligned}$$

1. Solve the linear programming problem by the method of corners.
2. Does this objective function have a maximum value? Explain why or why not.

Exercise 3. Graph the system of linear inequalities.

$$\begin{cases} x + y \geq 7 \\ x - 2y > -2 \\ 0 \leq x < 7,\ y \geq 0 \end{cases}$$

Please label all of your lines, clearly indicate at least two points on each line, distinguish between dashed and solid lines, and clearly indicate the solution set by labeling it with an "S".

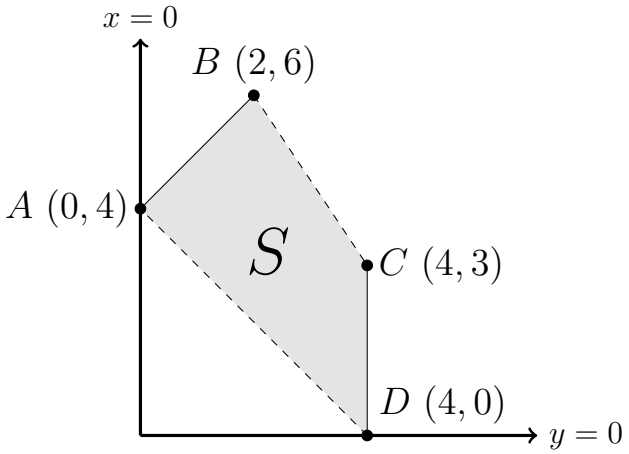
Exercise 4. Set up, but do NOT solve, a linear programming problem to solve the following:

The processing division of the Sunrise Breakfast Company must produce two tons (2000 pounds) of breakfast flakes per day to meet the demand for its Sugar Sweets cereal. Cost per pound of the three ingredients is as follows: Bran flakes cost \$4 per pound, cane sugar costs \$3 per pound, and salt costs \$2 per pound. Government regulations require that the mix contain at least 15% bran flakes and 20% sugar. Use of more than 800 pounds per ton of salt produces an unacceptable taste. How many pounds of each ingredient should be used to minimize the cost of the Sugar Sweets cereal mixture?

Exercise 5. Farmer Rev has 10 acres available to plant maroon and orange carrots. Each acre of maroon carrots will yield 2 tons of carrots and each acre of orange carrots will yield 4 tons of carrots. He wants to have at least three times as many tons of maroon carrots than he does of orange carrots. How many acres of each type of carrots should Farmer Rev plant to maximize his yield?

1. Set up a linear programming problem that can be used to answer the question.
2. Solve the linear programming problem using the method of corners.
3. Are there any leftover resources when the optimal solution is reached?

Exercise 6. Write a system of inequalities describing the solution set S in the figure.

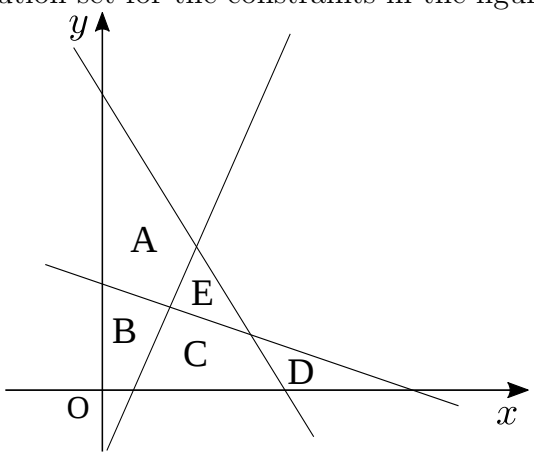


Multiple Choice Problems

Study tip: Write out all your work when you complete the multiple-choice problems.

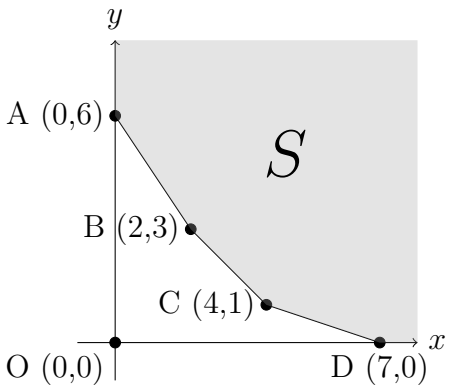
Multiple Choice 1. Find the solution set for the constraints in the figure on the right.

$$\begin{cases} 3x + 2y \leq 5 \\ 2x + 5y \leq 6 \\ 3x - y \leq 1, \\ x \geq 0,\ y \geq 0 \end{cases}$$



(a) A (b) B (c) C (d) D (e) E

Multiple Choice 2. The shaded region in following figure illustrates the unbounded feasible region of a linear programming problem. Given the objective function $P = 2x + 3y$, which of the following is **TRUE**?



I. The maximum of P is 18 at $A = (0, 6)$.
II. The minimum of P is 0 at $O = (0, 0)$.
III. The maximum of P is 21 at $D = (7, 0)$.
IV. The minimum of P is 11 at $C = (4, 1)$.

(a) I only

(b) I and II.

(c) II and III.

(d) II only.

(e) IV only.

Multiple Choice 3. Consider the system of linear inequalities:

$$\begin{cases} 3x + y \geq 7 \\ 2x + 3y \leq 14 \\ x + 3y \leq 10 \\ x \geq 0,\ y \geq 0 \end{cases}$$

What are the corners of the feasible region?

(a) $(1, 4), \left(\frac{11}{8}, \frac{23}{8}\right), (4, 2)$

(b) $(0, 7), (1, 4), (4, 2), (10, 0)$

(c) $(0, 0), \left(0, \frac{10}{3}\right), \left(\frac{11}{8}, \frac{23}{8}\right), \left(\frac{7}{3}, 0\right)$

(d) $(0, 0), (0, 7), (1, 4), \left(\frac{11}{8}, \frac{23}{8}\right), (10, 0)$

(e) None of these

Multiple Choice 4. A feasible region is given by

$$\begin{cases} x + y \leq 6 \\ 3x + y \leq 15 \\ x + 3y \leq 15 \\ x \geq 0,\ y \geq 0\ . \end{cases}$$

At how many points is the objective function $P = 0.5x + 1.5y$ maximized over the feasible region?

(a) There is no maximum.

(b) At exactly one point.

(c) At exactly two points.

(d) At infinitely many points.

(e) There is not enough information to determine.

Multiple Choice 5. Kane Manufacturing has a division that produces two models of grates, model A and model B. To produce each model A grate requires 3 pounds of cast iron and 6 minutes of labor. To produce each model B grate requires 4 pounds of cast iron and 3 minutes of labor. The profit for each model A grate is \$2, and the profit for each model B grate is \$1.50. There is no more than 100 pounds of cast iron available and at least 20 **hours** of labor must be made available for grate production each day. Because of backlog orders for model B grates, Kane's manager has decided to produce at least 180 model B grates per day. If A denotes the number of model A grates produced each day and B denotes the number of model B grates produced each day, which of the following will help the company maximize, P, Kane Manufacturing's profits?

(a)

$$\begin{aligned} \text{Objective : Maximize} \quad & P = 2A + 1.5B \\ \text{subject to} \quad & 3A + 4B \leq 100 \\ & 6A + 3B \geq 1200 \\ & A \geq 0,\ B \geq 180 \end{aligned}$$

(b)

$$\begin{aligned} \text{Objective : Maximize} \quad & P = 2A + 1.5B \\ \text{subject to} \quad & 3A + 4B \geq 100 \\ & 6A + 3B \leq 20 \\ & A \geq 0,\ B \geq 180 \end{aligned}$$

(c)

$$\begin{aligned} \text{Objective : Maximize} \quad & P = 2A + 1.5B \\ \text{subject to} \quad & 3A + 4B \leq 100 \\ & 6A + 3B \geq 1200 \\ & A \geq 0,\ B \geq 0 \end{aligned}$$

(d)

$$\begin{aligned} \text{Objective : Maximize} \quad & P = 2A + 1.5B \\ \text{subject to} \quad & 3A + 4B \leq 100 \\ & 6A + 3B \geq 20 \\ & A \geq 0,\ B \geq 0 \end{aligned}$$

(e) None of these.