3.2: Linear Programming Problems

A **linear programming problem** consists of a linear objective function to be maximized or minimized subject to certain constraints in the form of linear equations or inequalities.

   Set up the following linear programming problems (write the objective function and constraints). **Do not solve the problem.**

EXAMPLE 1. *The Acrosonic Company manufactures a model G loudspeaker system in plants I and II. The output at plant I is at most* 800 *systems per month, whereas the output at plant II is at most* 600 *per month.*
These loudspeaker systems are shipped to the three warehouses,A, B, and C, whose minimum monthly requirements are 500, 400, *and* 400, *respectively.*
Shipping costs from plant I to warehouse A, warehouse B, and warehouse C are \$16, \$20, *and* \$22 *per loudspeaker system, respectively, and shipping costs from plant II to each of these warehouses are* \$18, \$16, *and* \$14, *respectively.*
What shipping schedule will enable Acrosonic to meet the warehouses' requirements and at the same time keep its shipping costs to a minimum?

   Solution:
   x -   *the number of loudspeakers shipped from plant I to warehouse A.*
   y -   *the number of loudspeakers shipped from plant I to warehouse B.*
   z -   *the number of loudspeakers shipped from plant I to warehouse C.*
   u -   *the number of loudspeakers shipped from plant II to warehouse A.*
   v -   *the number of loudspeakers shipped from plant II to warehouse B.*
   w -   *the number of loudspeakers shipped from plant II to warehouse C.*

EXAMPLE 2. *Kane Manufacturing has a division that produces two models of fireplace grates, x units of model A and y units of model B.*
To produce each model A requires 2 lb of cast iron and 8 min of labor.
To produce each model B grate requires 4 lb of cast iron and 5 min of labor.
The profit for each model A grate is $1.00, and the profit for each model B grate is $2.40.
If 740 lb of cast iron and 1420 min of labor are available for the production of grates per day, how many grates of each model should the division produce per day in order to maximize Kane's profits P?

EXAMPLE 3. *A nutritionist at the Medical Center has been asked to prepare a special diet for certain patients.*
She has decided that the meals should contain a minimum of 308 mg of calcium, 20 mg of iron, and 41 mg of vitamin C.
She has further decided that the meals are to be prepared from x ounces of food A and y ounces of food B.
Each ounce of food A contains 26 mg of calcium, 2 mg of iron, 2 mg of vitamin C, and 3 mg of cholesterol.
Each ounce of food B contains 20 mg of calcium, 0.8 mg of iron, 5 mg of vitamin C, and 5 mg of cholesterol.
Find how many ounces of each type of food should be used in a meal so that the cholesterol, C, content is minimized and the minimum requirements of calcium, iron, and vitamin C are met?