Chapter 4 Homework problems
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Section 4.2

Solve these linear programming problems.

1. Minimize: $C = -3x - 2y - z$
   Constraints:
   $-x + 2y - z \leq 8$
   $x - 2y + 2z \leq 10$
   $2x + 4y - 3z \leq 20$
   $x, y, z \geq 0$

2. Minimize: $C = 4x + 5y - 9z$
   Constraints:
   $3x + 2y - 12z \leq 120$
   $2x + 4y + 6z \leq 120$
   $x - 2y + 3z \leq 52$
   $x, y, z \geq 0$

For these problems do the following.
A) State the dual problem.
B) Solve the dual problem and give the solution to the primal problem, i.e. origional problem.

3. Minimize: $f = 2x + 5y$
   Constraints:
   $4x + y \geq 40$
   $2x + y \geq 30$
   $x + 3y \geq 30$
   $x, y \geq 0$

4. Minimize $f = 10x + 16y + 20z$
   Constraints:
   $3x + y + 6z \geq 9$
   $x + y \geq 9$
   $4x + z \geq 12$
   $x \geq 0,\ y \geq 0,\ z \geq 0$

5. Minimize: $C = 4x + 2y$
   Constraints:
   $3x + 2y \geq 5$
   $7x - 8y \leq 1$
   $x \geq 0,\ y \geq 0$

6. Minimize: $C = 4x + 5y + z$
   Constraints:
   $10x + 12y + 5z \geq 100$
   $5x + 7y + 5z \leq 75$
   $x, y, z \geq 0$

7. 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? What is the minimum shipping cost?

   Note: set up of this problem was covered in section 3.2
   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.

   Objective function:
   $C = 16x + 20y + 22z + 18u + 16v + 14w$ minimized

   Constraints:
   $x + y + z \leq 800$
   $u + v + w \leq 600$
   $x + u \geq 500$
   $y + v \geq 400$
   $z + w \geq 400$
   $x, y, z, u, v, w \geq 0$