

8.2.1: Maximization Applications (Exercises)

For the following maximization problems, choose your variables, write the objective function and the constraints, graph the constraints, shade the feasibility region, label all critical points, and determine the solution that optimizes the objective function.

1) A farmer has 100 acres of land on which she plans to grow wheat and corn. Each acre of wheat requires 4 hours of labor and \$20 of capital, and each acre of corn requires 16 hours of labor and \$40 of capital. The farmer has at most 800 hours of labor and \$2400 of capital available. If the profit from an acre of wheat is \$80 and from an acre of corn is \$100, how many acres of each crop should she plant to maximize her profit?

2) Mr. Tran has \$24,000 to invest, some in bonds and the rest in stocks. He has decided that the money invested in bonds must be at least twice as much as that in stocks. But the money invested in bonds must not be greater than \$18,000. If the bonds earn 6%, and the stocks earn 8%, how much money should he invest in each to maximize profit?

3) A factory manufactures chairs and tables, each requiring the use of three operations: Cutting, Assembly, and Finishing. The first operation can be used at most 40 hours; the second at most 42 hours; and the third at most 25 hours. A chair requires 1 hour of cutting, 2 hours of assembly, and 1 hour of finishing; a table needs 2 hours of cutting, 1 hour of assembly, and 1 hour of finishing. If the profit is \$20 per unit for a chair and \$30 for a table, how many units of each should be manufactured to maximize revenue?

4) The Silly Nut Company makes two mixtures of nuts: Mixture A and Mixture B. A pound of Mixture A contains 12 oz of peanuts, 3 oz of almonds and 1 oz of cashews and sells for \$4. A pound of Mixture B contains 12 oz of peanuts, 2 oz of almonds and 2 oz of cashews and sells for \$5. The company has 1080 lb. of peanuts, 240 lb. of almonds, 160 lb. of cashews. How many pounds of each of mixtures A and B should the company make to maximize profit?

(Hint: Use consistent units. Work the entire problem in pounds by converting all values given in ounces into fractions of pounds).

5)

$$\begin{array}{ll}\text{Maximize:} & Z = 4x + 10y \\ \text{Subject to:} & x + y \leq 5 \\ & 2x + y \leq 8 \\ & x + 2y \leq 8 \\ & x \geq 0, y \geq 0\end{array}$$

6) This maximization linear programming problem is not in “standard” form. It has mixed constraints, some involving \leq inequalities and some involving \geq inequalities. However with careful graphing, we can solve this using the techniques we have learned in this section.

$$\begin{array}{ll}\text{Maximize:} & Z = 5x + 7y \\ \text{Subject to:} & x + y \leq 30 \\ & 2x + y \leq 50 \\ & 4x + 3y \geq 60 \\ & 2x \geq y \\ & x \geq 0, y \geq 0\end{array}$$

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