

MAT540

Week 7 Homework

Chapter 3

1. Southern Sporting Good Company makes basketballs and footballs. Each product is produced from two resources rubber and leather. Each basketball produced results in a profit of \$11 and each football earns \$15 in profit. The resource requirements for each product and the total resources available are as follows:

Product	Resource Requirements per Unit	
	Rubber (lb.)	Leather (ft ²)
Basketball	2.8	3.7
Football	1.5	5.2
Total resources available	600	900

- Find the optimal solution.
 - What would be the effect on the optimal solution if the profit for the basketball changed from \$11 to \$12?
 - What would be the effect on optimal solution if 400 additional pounds of rubber could be obtained? What would be the effect if 600 additional square feet of leather could be obtained?
2. A company produces two products, A and B, which have profits of \$9 and \$7, respectively. Each unit of product must be processed on two assembly lines, where the required production times are as follows:

Product	Resource Requirements per Unit	
	Line 1	Line 2
A	11	5
B	6	9
Total Hours	65	40

- Formulate a linear programming model to determine the optimal product mix that will maximize profit.

- b. What are the sensitivity ranges for the objective function coefficients?
 - c. Determine the shadow prices for additional hours of production time on line 1 and line 2 and indicate whether the company would prefer additional line 1 or line 2 hours.
3. Formulate and solve the model for the following problem:

Irwin Textile Mills produces two types of cotton cloth denim and corduroy. Corduroy is a heavier grade of cotton cloth and, as such, requires 8 pounds of raw cotton per yard, whereas denim requires 6 pounds of raw cotton per yard. A yard of corduroy requires 4 hours of processing time; a yard of denim requires 3.0 hours. Although the demand for denim is practically unlimited, the maximum demand for corduroy is 510 yards per month. The manufacturer has 6,500 pounds of cotton and 3,000 hours of processing time available each month. The manufacturer makes a profit of \$2.5 per yards of denim and \$3.25 per yard of corduroy. The manufacturer wants to know how many yards of each type of cloth to produce to maximize profit. Formulate the model and put it into standard form. Solve it

- a. How much extra cotton and processing time are left over at the optimal solution? Is the demand for corduroy met?
 - b. If Irwin Mills can obtain additional cotton or processing time, but not both, which should it select? How much? Explain your answer.
4. The Bradley family owns 410 acres of farmland in North Carolina on which they grow corn and tobacco. Each acre of corn costs \$105 to plant, cultivate, and harvest; each acre of tobacco costs \$210. The Bradleys' have a budget of \$52,500 for next year. The government limits the number of acres of tobacco that can be planted to 100. The profit from each acre of corn is \$300; the profit from each acre of tobacco is \$520. The Bradleys' want to know how many acres of each crop to plant in order to maximize their profit.
- a. Formulate the linear programming model for the problem and solve.
 - b. How many acres of farmland will not be cultivated at the optimal solution? Do the Bradleys use the entire 100-acre tobacco allotment?
 - c. The Bradleys' have an opportunity to lease some extra land from a neighbor. The neighbor is offering the land to them for \$110 per acre. Should the Bradleys' lease the land at that price? What is the maximum price the Bradleys' should pay their neighbor for the land, and how much land should they lease at that price?

- d. The Bradleys' are considering taking out a loan to increase their budget. For each dollar they borrow, how much additional profit would they make? If they borrowed an additional \$1,000, would the number of acres of corn and tobacco they plant change?