**Linear Programming Mini-Lesson**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Per Table | Per Bookcase | Available |
| Woodworking time (hours) | 6 | 4 | 48 |
| Finishing time (hours) | 3 | 4 | 30 |
| Profit (dollars) | 160 | 200 | - |

**1)** Furniture Manufacturing

Willow Woods Furniture Factory makes tables and bookcases. In an effort to fine-tune production and increase profits, data have been collected on the labor requirements and profit margins on each piece of furniture. These data are summarized in table 15. For example, each table requires 6 hours of woodworking, 3 hours of finishing, and yields a profit of $160. Without hiring additional labor, there are 48 hours available each day for woodworking and 30 hours each day for finishing. Because of incoming orders, the factory must make at least 2 tables each day. The owners would like to know how many tables and how many bookcases should be made each day to maximize profit.

**Step 1** Chew on the problem a bit. Mark the text.

**Step 2** Assign variables to unknowns and write the objective function

*x =*

*y =*

We wish to maximize profit from the sale of *x* \_\_\_\_\_\_\_\_\_\_\_\_\_ and *y* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

P (x,y) =

This is the **objective function**, the quantity to be maximized.

**Step 3** Write out the inequalities that correspond to the constraints in the problem.

Hours of woodworking for tables + Hours of woodworking for bookcases is at most 48

*Write this constraint algebraically 🡪*

There are three more constraints:

Furniture continued…

**Step 4** Graph the system of inequalities to obtain the feasible region.



**Step 5** Locate the vertices of the feasible region.

**Step 6** Evaluate the objective function at each vertex, and identify the optimum solution. Communicate this solution clearly with full sentences.

**Linear Programming Practice Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2)** Clothing Profits

|  |  |  |
| --- | --- | --- |
|  | Style A | Style B |
| Cutting (hours) | 2 | 4 |
| Sewing (hours) | 3 | 2 |
| Profit (dollars) | 35 | 40 |

A clothing company makes two styles of tailored suits. The labor requirements and profit margins for each style are given in Table 17. If 56 hours are available per day for cutting and 72 hours per day for sewing, how many suits of each style should be made to maximize profit?

**3)** Biology Samples
A biologist is developing two new strains of bacteria. Each sample of Type I bacteria produces four new viable bacteria, and each sample of Type II bacteria produces 3 new viable bacteria. Altogether, at least 240 new viable bacteria must be produced. At least 30, but not more than 60, of the original samples must be Type I. Not more than 70 of the samples can be Type II. A sample of Type I costs $5 and a sample of Type II costs $7. How many of samples of each type should be used to minimize cost?

**Linear Programming Practice Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
After Activity 1.2 (Locate vertices algebraically)

**4)** Nutrition
Ronald is on a diet. The daily fruit portion of his diet must have as few calories as possible and yet provide at least 750 units of vitamin A, 0.72 unit of Vitamin B6, and 60 units of vitamin C. His fruit bowl contains a few small bananas and oranges. Use the nutritional information given in Table 16 to determine which combination of bananas and oranges will yield the fewest calories, and yet the nutritional needs.



**5)**  Investment Options
Damon has $10,000 to invest in selected stocks and bonds. For tax reasons, his accountant has advised that he invest at least twice as much in bonds as in stocks. However, his financial adviser suggests that he invest at least $2,500 in stocks. If the stocks average a 12% return and the bonds average a 10% return, how much should he invest in each to maximize his earnings.

**6)** Refinery Production
An oil company owns two refineries. The daily production limits and operating costs for each refinery are given ion Table 19. An order is received for 1000 barrels of high-grade oil, 1000 barrels of medium-grade oil, and 1800 barrels of low-grade oil. How many days should each refinery be operated so that the order can be filled at the least cost?



Land Allocation
A farmer intends to grow corn and hay. Between available cash and a bank line of credt, he has $50,000 available to invest in the two crops. Moreover, he and his son have a total of 1200 hours of labor available to devote to these two crops. Use the information given in the table to determine how many acres of each crop should be planted to maximize revenue.

|  |  |  |
| --- | --- | --- |
|  | Corn | Hay |
| Investment (dollars per acre) | 125 | 100 |
| Labor (hours per acre) | 2 | 6 |
| Revenue (dollars per acre) | 245 | 210 |

**Answers**

1) (6, 3) max profit $1,560

2) 22 Type A, 3 Type B

3) 170 of Type I and 70 Type II

4) Vertices (0, 12), (1, 2), (2.5, 0.5), (5, 0). Minimum of 220 calories at (1, 2)



5) max at (6667, 3333)

6) 4 days Refinery 1 and 3 days Refinery 2