

Applied Optimization Problem Assignment #3

Directions: Choose one maximize and one minimize problem. You need to organize all of your work and include the following: (a) define the variables, (b) objective function, (c) constraints, (d) graph of the constraints with axes labeled appropriately, (e) vertices of the feasible region with any necessary verification, (f) evaluate the objective function at each of the vertices of the feasible region, and (g) answer to the question(s).

- 1. MAXIMIZE PROFIT** Among the many products it produces, an oil refinery makes two specialized petroleum distillates: Pymex A and Pymex B. Each distillate passes through three stages: S_1 , S_2 , and S_3 . Each liter of Pymex A requires 1 hour in S_1 , 3 hours in S_2 , and 3 hours in S_3 . Each liter of Pymex B requires 1 hour in S_1 , 4 hours in S_2 , and 2 hours in S_3 . There are 10 hours available for S_1 , 36 hours available for S_2 , and 27 hours available for S_3 . The profit per liter of Pymex A is \$12, and the profit per liter of Pymex B is \$9. How many liters of each distillate should be produced to maximize profit? What is the maximum profit?
- 2. MINIMIZE COST** A dietitian formulates a special diet from two food groups: A and B. Each ounce of food group A contains 3 units of vitamin A, 1 unit of vitamin C, and 1 unit of vitamin D. Each ounce of food group B contains 1 unit of vitamin A, 1 unit of vitamin C, and 3 units of vitamin D. Each ounce of food group A costs 40 cents, and each ounce of food group B costs 10 cents. The dietary constraints are such that at least 24 units of vitamin A, 16 units of vitamin C, and 30 units of vitamin D are required. Find the amount of each food group that should be used to minimize the cost. What is the minimum cost?
- 3. MAXIMIZE PROFIT** An engine reconditioning company works on 4- and 6-cylinder engines. Each 4-cylinder engine requires 1 hour for cleaning, 5 hours for overhauling, and 3 hours for testing. Each 6-cylinder engine requires 1 hour for cleaning, 10 hours for overhauling, and 2 hours for testing. The cleaning station is available for at most 9 hours. The overhauling equipment is available for at most 80 hours, and the testing equipment is available for at most 24 hours. For each reconditioned 4-cylinder engine, the company makes a profit of \$150. A reconditioned 6-cylinder engine yields a profit of \$250. The company can sell all the reconditioned engines it produces. How many of each type should be produced to maximize profit? What is the maximum profit?
- 4. MINIMIZE COST** A producer of animal feed makes two food products: F_1 and F_2 . The products contain three major ingredients: M_1 , M_2 , and M_3 . Each ton of F_1 requires 200 pounds of M_1 , 100 pounds of M_2 , and 100 pounds of M_3 . Each ton of F_2 requires 100 pounds of M_1 , 200 pounds of M_2 , and 400 pounds of M_3 . There are at least 5000 pounds of M_1 available, at least 7000 pounds of M_2 available, and at least 10,000 pounds of M_3 available. Each ton of F_1 costs \$450 to make, and each ton of F_2 costs \$300 to make. How many tons of each food product should the feed producer make to minimize cost? What is the minimum cost?