Assignment 7

Due Friday, April 12 at 11:59 pm.

Please submit all work on Canvas as a PDF or Word file. Make sure you clearly label each solution, and include the answers to the in-class quiz at the beginning of the assignment.

Solving Optimization Problems

1) Woodworking, Revisited A woodworking shop makes two products, cabinets and tables. Each cabinet brings $800 of profit, and each table brings $500. The companys carpentry shop has a capacity of 120 hours per week. Its finishing shop has a capacity of 80 hours per week. Making each cabinet requires 20 hours of carpentry and 10 hours of finishing. Making each table requires 12 hours of carpentry and 10 hours of finishing. The company wishes to determine the product mix that maximizes profit.

(a) **What are the decision variables, objective function, and constraints? (2 point)**

(b) **How many cabinets and tables should they make? What is the profit they would make from this? Use Solver to find the answer. (3 points)**

(c) **A way has been found to reduce the time needed in the carpentry shop for each table from 12 hours to 10. Solve the new problem. Does the optimal solution change? Why/why not? Do you find the change in the product mix surprising, given that a table now is produced in a shorter amount of time? (4 points)**

2) Pizza and Calzones, Revisited A pizza vendor sells pizzas and calzones at a sporting event. Since it is very well attended, the vendor is certain all of their pizzas and calzones will sell out. Pizzas can be sold for a profit of $3.50 and use 500 grams of dough, 300 grams of sauce, and 150 grams of cheese. Calzones can be sold for a profit of $2.50 and use 750 grams of dough, 200 grams of sauce, and 250 grams of cheese. If the vendor has 112,500 grams of dough, 60,000 grams of sauce, and 36,000 grams of cheese, how many pizzas and calzones should they make?

(a) **What are the decision variables, objective function, and constraints? (2 points)**

(b) **How many pizzas and calzones should they make? What is the profit they would make from this? Use Solver to find the answer. (4 points)**

3) Training Programs As part of a quality improvement initiative, Consolidated Electronics employees complete a three-day training program on teaming and a two-day training program on problem solving. The manager of quality improvement requested that at least 8 training programs on teaming and at least 10 training programs on problem solving be offered during the next six months. In addition, senior-level management specified that at least a total of 25 training programs must be offered during this period. Consolidated Electronics uses a consultant to teach the training programs. During the next six months, the consultant has 84 days of training time available. Each training program on teaming costs $10,000 and each training program on problem solving costs $8,000.

(a) **What are the decision variables? (2 points)**

(b) **What is the objective function? (2 points)**

(c) **What are the constraints? (3 points)**

(d) **How many training programs of each type should be offered? What would be the total cost of this? (3 points)**

4) Diet Suppose you are trying to construct the optimal lunch bowl using various ingredients. Their nutritional facts and cost per serving are shown below.

	Rice	**Black Beans**	**Corn**	**Chicken**
Calories	200	90	100	190
Fat	0.4g	0.5g	1.5g	11g
Carbohydrates	45g	19g	22g	0g
Protein	4.3g	7g	3.5g	20g
Cost	\$0.20	\$0.30	\$0.10	\$0.75

Suppose you want to make sure that the lunch bowl has at least 500 calories and 15 grams of protein, with less than 15 grams of fat and 60 grams of carbohydrates.

(a) **What are the decision variables? (2 points)**

(b) **What is the objective function? (2 points)**

(c) **What are the constraints? (3 points)**

(d) **What is the best way to construct the bowl? That is, how many servings of each ingredient should you use? How much would it cost? Assume that you can measure out continuous values of servings (it does not need to be an integer). Round each answer to two decimal places. (3 points)**