

BIDA 650 Business Analytics

Homework 2 (Individual)

Question 1 (25%)

More than 46,000 farms spread across 8.4 million acres of land in NC State, with average farm size ringing in at 182 acres. A farmer in Hendersonville owns 50 acres of land. He is going to plant each acre with Apples or Pumpkins. Each acre planted with Apples yields \$400 profit; each with Pumpkins yields \$200 profit. The labor and fertilizer used for each acre are given in the table below. Resources available include 150 workers and 200 tons of fertilizer. **Using EXCEL.**

	Apples	Pumpkins
Labor (Workers)	5	3
Fertilizer (Tons)	6	2

- (A) Formulate a linear programming model that will enable the farmer to determine the number of acres that should be planted Apples and/or Pumpkins in order to maximize his profit.
- (B) Find an optimal solution to the model in (A) and determine the maximum profit.
- (C) Implement the model in (A) in Excel Solver and obtain an answer report. Which constraints are binding on the optimal solution?
- (D) Obtain a sensitivity report for the model in (A). How much should the farmer be willing to pay for an additional worker?
- (E) Suppose the farmer hires 10 additional workers. Can you use the sensitivity analysis obtained for (D) to determine his expected profit? Would his planting plan change? Explain your answer.
- (F) **Using SAS Code** to run an optimization problem and print output decision variables, objective function Z, and constraints solutions. You need to provide your Code on a separate file called it **SAS_Problem1.sas**

Question 2 (50%)

Assume that you have decided to enter the Chocolate Truffle business. You are considering producing two types of Truffle: A and B, both of which consist solely of sugar, nuts, and chocolate. At present you have 12,000 ounces of sugar, 3000 ounces of nuts, and 3000 ounces of chocolate in stock. The mixture used to make Truffle A must contain at least 10% nuts 80% sugar, and 10% chocolate. The mixture used to make Truffle B must contain at least 10% chocolate, 70% sugar, and at least 20% nuts. Each ounce of Truffle A can be sold for \$0.40 and each ounce of Truffle for B \$0.50. Determine how you can maximize your revenues from Truffle sales using linear programming approach. Provide a linear programming formulation, notation and solution using **ONLY EXCEL Solver.**

Question 3 (10%)

Using **ONLY SAS Code** to run an optimization problem and print output decision variables, objective function Z, and constraints solutions. Code on a separate file called it **SAS_Problem3.sas**

A boutique chocolatier - Lafayette Village Raleigh has two most sellable products:
Its flagship assortment of triangular chocolates, called Pyramide, and the more decadent and deluxe Pyramide Nut and Caramel.

How much of each should it produce to maximize profits?

Every box of Pyramide has a profit of \$1.

Every box of Nut and Caramel has a profit of \$6.

The daily demand is limited to at most 200 boxes of Pyramide and 300 boxes of Nut and Caramel.

The current workforce can produce a total of at most 400 boxes of chocolate per day.

Let x_1 be # of boxes of Pyramide, x_2 be # of boxes of Nut and Caramel

Question 4 (15%)

Costco company is a vertically integrated company (both producing and selling the goods in its own retail outlets). After production, the goods are stored in two warehouses until needed by retail outlets. Trucks are used to transport the goods from two plants to two warehouses, and then from the warehouses to the three retail outlets. Using full truckloads, the following table shows each plant's monthly output, its shipping cost per truckload sent to each warehouse and the maximum amount it can ship per month to each warehouse.

From	Unit Shipping Cost		Shipping Capacity		Output
	To Warehouse 1	To Warehouse 2	Warehouse 1	Warehouse 2	
Plant 1	\$425	\$560	125	150	200
Plant 2	\$510	\$600	175	200	300

For each retail outlet (RO), the next table shows its monthly demand, its shipping cost from each warehouse, and the maximum amount that can be shipped per month from each warehouse. The management wants to determine a distribution plan that will minimize the total shipping cost.

From	Unit Shipping Cost			Shipping Capacity		
	To RO1	To RO2	To RO3	RO1	RO2	RO3
Warehouse 1	\$470	\$500	\$450	100	150	100
Warehouse 2	\$390	\$400	\$410	125	150	75
Demand	150	200	150	150	200	150

- Draw a graph that shows the company's distribution network. Identify the supply nodes, transshipment nodes and demand nodes. Write down the arc costs and capacities.
- Formulate this problem as a linear programming formulation with notation.
- Use **Only Excel solver** to find the optimal solution and report your solution.