California State University, East Bay

College of Business and Economics

BAN 630: Optimization for Analytics

**Homework 2**

**Due: 11:59 pm Sunday, June 28, 2020**

Instructions:

* **Build Spreadsheet/Optimization Models to solve this homework.**
* Explain your answer and reasoning clearly.
* You may work in groups, but write/type your own homework report.
* **You can use the template to solve the questions but feel free to put aside the template and build your own models.**
* **Upload your finished Excel file unto Blackboard.**

Question 1.

Eastinghouse sells air conditioners. The annual demand for air conditioners in each region of the country is as follows: East, 100,000; South, 150,000; Midwest, 110,000; and West, 90,000. Eastinghouse is considering building its air conditioners in four different cities: New York, Atlanta, Chicago, and Los Angeles. The cost of producing an air conditioner in a city and shipping it to a region of the country is given in the excel template file. Any factory can produce up to 150,000 air conditioners per year. The annual fixed cost of operating a factory in each city is given in the same file. At least 50,000 units of the Midwest demand for air conditioners must come from New York, and at least 50,000 units of the Midwest demand must come from Atlanta. Determine how Eastinghouse can minimize the annual cost of meeting demand for air conditioners.

Question 2.

If a monopolist set the unit price as p, her demand will be 100 – 0.25p. The variable cost is $60 per unit.

a. How can the monopolist maximize her profit?

b. If the monopolist must pay a sales tax of 5% of the selling price per unit, will she increase or decrease product (relative to the situation with no sales tax)?

(Hint: Sales tax = sales tax percentage X revenue)

Question 3.

Based on Grossman and Hart (1983). A salesperson for Fuller Brush has three options: (1) quit, (2) put forth a low level of effort, or (3) put forth a high level of effort. Suppose for simplicity that each salesperson will sell $0, $5000, or $50,000 worth of brushes. The probability of each sales amount depends on the effort level as described in the excel template file. If a salesperson is paid w dollars, he or she regards this as a “benefit” of units. In addition, low effort costs the salesperson 0 benefit units, whereas high effort costs 50 benefit units. If a salesperson were to quit Fuller and work elsewhere, he or she could earn a benefit of 20 units. Fuller wants all salespeople to put forth a high level of effort. The question is how to minimize the cost of encouraging them to do so. The company cannot observe the level of effort put forth by a salesperson, but it can observe the size of his or her sales. Thus, the wage paid to the salesperson is completely determined by the size of the sale. This means that Fuller must determine w0, the wage paid for sales of $0; w5000, the wage paid for sales of $5000; and w50,000, the wage paid for sales of $50,000. These wages must be set so that the salespeople value the expected benefit from high effort more than quitting and more than low effort. Determine how to minimize the expected cost of ensuring that all salespeople put forth high effort. (This problem is an example of agency theory)