46-893: Operations and Supply Chain Analytics

(Individual) Assignment #1

Due by 5:00pm Eastern Time, March 31 (Sunday)

Instructions:

Submit both a write up and your excel files electronically on Canvas. Each question should at least be on a different worksheet or a different workbook. Be sure to include your name in the document.

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1. (20 points) SC Consulting, a supply chain consulting firm, must decide on the location of its home offices. Its clients are located primarily in the 16 states listed in Table A1-1. There are four potential sites for home offices: Los Angeles, Tulsa, Denver, and Seattle. The annual fixed cost of locating an office in Los Angeles is $165,428, Tulsa is $131,230, Denver is $140,000, and Seattle is $145,000. The expected number of trips to each state and the travel costs from each potential site are given. Each consultant is expected to take at most 25 trips each year.

    a. If there are no restrictions on the number of consultants at a site and the goal is to minimize costs, where should the home offices be located and how many consultants should be assigned to each office? What is the annual cost in terms of the facility and travel?
    b. If at most 10 consultants are to be assigned to a home office, where should the offices be set up? How many consultants should be assigned to each office? What is the annual cost of this network?

2. (40 points) StayFresh, a manufacturer of refrigerators in India, has two plants—one in Mumbai and the other in Chennai. Each plant has an annual capacity of 300,000 units. The two plants serve the entire country, which is divided into four regional markets: the north, with a demand of 100,000 units; the west, with a demand of 150,000 units; the south, with a demand of 150,000 units; and the east, with a demand of 50,000 units. Two other potential sites for plants include Delhi and Kolkata. The variable production and transport costs per refrigerator from each potential production site to each market are as shown in Table A1-2.

    StayFresh is anticipating a compounded growth in demand of 20 percent per year for the next five years and must plan its network investment decisions. Demand is anticipated to stabilize after five years of growth. Capacity can be added in increments of either 150,000 or 300,000 units. Adding 150,000 units of capacity incurs a one-time cost of 2 million rupees, whereas adding 300,000 units of capacity incurs a one-time cost of 3.4 million rupees. Assume that StayFresh plans to meet all demand (prices are sufficiently high) and that capacity for each year must be in place by the beginning of the year. Also assume that

the cost for the fifth year will continue for the next 10 years- that is, years 6 to 15. Assume a discount factor of 0.20. In general, to find the present value of revenue earned after t years, one should multiply it by $1/(1+r)^t$ (where r is the discount factor).

a. How should the production network for the company evolve over the next five years?
b. How does your answer change if the anticipated growth is 15 percent? 25 percent?

3. (10 points) Harley-Davidson has its engine assembly plant in Milwaukee and its motorcycle assembly plant in Pennsylvania. Engines are transported between the two plants using trucks, with each trip costing $1,000. The motorcycle plant assembles and sells 300 motorcycles each day. Each engine costs $500; Harley incurs an annual holding cost of 20 percent per year. How many engines should Harley load onto each truck?

4. (10 points) As part of its initiative to implement just-in-time (JIT) manufacturing at the motorcycle assembly plant in last question, Harley has reduced the number of engines loaded on each truck to 100. If each truck trip still costs $1,000, how does this decision affect annual inventory costs at Harley? What should the cost of each truck be if a load of 100 engines is to be optimal for Harley?

5. (15 points) Green Thumb, a manufacturer of lawn care equipment, has introduced a new product. Each unit costs $150 to manufacture, and the introductory price is $200. At this price, the anticipated demand is normally distributed, with a mean of μ=100 and a standard deviation of σ=40. Any unsold units at the end of the season will be disposed of in a post-season sale for $50 each. It costs $20 to hold a unit in inventory for the entire season. How many units should Green Thumb manufacture for sale? What is the expected profit from this policy? On average, how many customers does Green Thumb expect to turn away because of stocking out?