BAN 630 Final Exam Summer 2020

Name:_____

Type your answers in the Excel File Template. Submit your finished excel file onto Blackboard.

Question 1.

Dataware is trying to determine whether to give a $10 rebate, cut the price $6, or have no price change on a software product. Currently, 40,000 units of the product are sold each week for $45 apiece. The variable cost of the product is $5. The most likely case appears to be that a $10 rebate will increase sales 30%, and half of all people will claim the rebate. For the price cut, the most likely case is that sales will increase 20%.

a. Given all other assumptions, what increase in sales from the rebate would make the rebate and price cut equally desirable?

b. Dataware does not really know the increase in sales that will result from a rebate or price cut. However, the company is sure that the rebate will increase sales by between 15% and 40% and that the price cut will increase sales by between 10% and 30%. Perform a sensitivity analysis (two-way data table) that could be used to help determine Dataware's best decision. (*Hint: in the template, cell E17 is already setup right for you. This cell compares the profit and shows the best policy.*)

Question 2.

Based on Charnes and Cooper (1955). A small company is trying to determine employee salary based on the following attributes: effectiveness, responsibility, initiative, experience, education, self-expression, planning ability, intelligence, and the ability to get things done. Each of the company's seven executives has been rated on each of these attributes, with the ratings shown in the excel template file. The company wants to set each executive's salary by multiplying a weight for each attribute by the executive's score on each attribute. The salaries must satisfy the following constraints:

- The salary of a lower-numbered executive must be at least as large as the salary of a higher-numbered executive.

- Executive 1's salary can be at most $160,000 and executive 7's salary must be at least $40,000.

- The salaries of executives 1, 5, and 7 should match $160,000, $100,000, and $40,000, respectively, **as closely as possible**.

- All attribute weights must be nonnegative.

Develop a **linear optimization model** for setting salaries.
(*Hint: For executives 1, 5, and 7, define "over" and "under" decision variable cells and add a constraint such as Executive 5 salary + (Amount executive 5 salary under $100,000) - (Amount executive 5 salary over $100,000) = $100,000. Then the objective cell to minimize is the sum of over and under decision variable cells for positions 1, 5, and 7. If you did not include the over and under decision variable cells, why would your model fail to be linear?)*

Question 3.

California State University East Bay is scheduling 24 sections of a large computer skills course in the Fall semester. There are eight time slots for these sections, four on Monday/ Wednesday (MW) and four on Tuesday/Thursday (TR). In each time slot, three sections are scheduled. These are shown in the excel template file. The sections will be taught by six instructors. Instructors 1 to 3 must teach at least three sections and no more than four sections each. Instructors 4 to 6 must teach at least four sections and no more than five sections each. The instructors have submitted their top four preferences for time slots, as shown in the file. Four points are awarded for satisfying an instructor's first preference, three for second preference, two for third preference, and one for fourth preference. These points appear in the file. For example, instructor 1's preferences are, in decreasing order, MW 9-10, MW 11-noon, MW 1-2, and TR 11-noon. Find an assignment of instructors to sections that maximizes the points from satisfying preferences. Of course, no instructor can teach more than one section in the same time slot.

Question 4.

Based on Kolesar and Blum (1973). Suppose that a company must service customers lying in an area of A square miles with n warehouses. Kolesar and Blum showed that when the warehouse(s) are located properly, the average distance between a warehouse and a customer is $(\frac{A}{n})^{\frac{1}{2}}$. Assume that it costs the company $90,000 per year to maintain a warehouse and $5,000,000 to build a warehouse. Also, assume that this $5,000,000 building cost is equivalent to incurring a cost of $500,000 per year indefinitely. The company fills 180,000 orders per year, and the shipping cost per order is $1.25 per mile. If the company serves an area of 120 square miles, how many warehouses (make it as an integer variable) should it have?