Santa Clara University

M3: Application Assignment

INSTRUCTIONS

Work with your group members to answer the following questions.

QUESTIONS

Question 1:

Use Gurobi API to solve the problem and create a Sensitivity Report. Use this information to answer the following questions:

$$\begin{aligned} \text{Max:} \quad & 4X_1 + 2X_2 \\ \text{Subject to:} \quad & 2X_1 + 4X_2 \leq 20 \\ & 3X_1 + 5X_2 \leq 15 \\ & X_{1,}\, X_2 \geq 0 \end{aligned}$$

A. What range of values can the objective function coefficient variable X_1 assume without changing the optimal solution?
B. Is the optimal solution to this problem unique, or are there alternate optimal solutions?
C. How much does the objective function coefficient for variable X_2 have to increase before it enters the optimal solution at a strictly positive level?
D. What is the optimal objective function value if X_2 equals 1?
E. What is the optimal objective function value if the RHS value for the second constraint changes from 15 to 25?
F. Is the current solution still optimal if the coefficient for the X_2 in the second constraint changes from 5 to 1? Explain.

Question 2:

Note: This question is a continuation from a question in the Module 2 Homework Assignment.

Valu-Com Electronics manufactures five different models of telecommunications interface cards for PCs and laptops. As summarized in the following table, each of these devices requires differing amounts of printed circuit board, resistors, memory chips, and assembly.

	Per Unit Requirements				
	HyperLink	FastLink	SpeedLink	MicroLink	EtherLink
Printed Circuit Board (square inches)	20	15	10	8	5
Resistors	28	24	18	12	16

Memory Chips	8	8	4	4	6
Assembly Labor (in hours)	0.75	0.6	0.5	0.65	1

The unit wholesale price and manufacturing cost for each model are as follows:

	Per Unit Requirements				
	HyperLink	**FastLink**	**SpeedLink**	**MicroLink**	**EtherLink**
Wholesale Price	$189	$149	$129	$169	$139
Manufacturing Cost	$136	$101	$96	$137	$101

In its next production period, Valu-Com has 80,000 square inches of PC board, 100,000 resistors, 30,000 memory chips, and 5,000 hours of assembly time available. The company can sell all the product it can manufacture, but the marketing department wants to be sure the company produces at least 500 units of each product and at least twice as many FastLink cards as HyperLink cards while maximizing profit.

A. Use Gurobi API to create a Sensitivity Report.
B. Which of the constraints in the problem are binding?
C. If the company was going to eliminate one of its products, which one should it be?
D. If the company could by 1,000 additional memory chips at the usual cost, should they, do it? If so, how much would profits increase?
E. Suppose the manufacturing costs used in this analysis were estimated hastily and are known to be somewhat imprecise. Which products would you be most concerned about having more precise cost estimates for before implementing this solution?

Question 3:

Note: This question is a continuation from a question in the Module 2 Homework Assignment.

The Rent-A-Dent car rental company allows its customers to pick up a rental car at one location and return it to any of its locations. Currently, two locations (1 and 2) have 16 and 18 surplus cars, respectively, and four locations (3, 4, 5, and 6) each need 10 cars. The costs of getting the surplus cars from locations 1 and 2 to the other locations are summarized in the following table.

	Costs of Transporting Cars Between Locations			
	Location 3	**Location 4**	**Location 5**	**Location 6**

Location 1	$54	$17	$23	$30
Location 2	$24	$18	$19	$31

Because 34 surplus cars are available at locations 1 and 2, and 40 cars are needed at locations 3, 4, 5, and 6, some locations will not receive as many cars as they need. However, management wants to make sure that all the surplus cars are sent where they are needed, and that each location needing cars receives at least five.

A. Use Gurobi API to create a Sensitivity Report.
B. Is the optimal solution unique? How can you tell?
C. Which location is receiving the fewest cars?
D. Suppose a particular car at location 1 must be sent to location 3 in order to meet a customer's request. How much does this increase cost for the company?
E. Suppose location 6 must have at least eight cars shipped to it. What impact does this have on the optimal objective function value?