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Due Date: 17th May 2022 (In class)
Home Work # 6
Total Points 70
SENSITIVITY ANALYSIS (70 points)

Home Work # 6

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Q1. The Furniture Company manufactures desks, tables, and chairs. The manufacture of each type of furniture requires lumber and two types of skilled labor: finishing and carpentry. The amount of each resource needed to make each type of furniture is given in Table 4.

Currently, 48 board feet of lumber, 20 finishing hours, and 8 carpentry hours are available. A desk sells for $60, a table for $30, and a chair for $20. Because the available resources have already been purchased, the company wants to maximize total revenue.

Resource	Desk	Table	Chair
Lumber (board ft.)	8	6	1
Finishing hours	4	2	1.5
Carpentry hours	2	1.5	0.5

Defining the decision variables as:

x_1 = number of desks produced
x_2 = number of tables produced
x_3 = number of chairs produced

Following is the initial LP formulation of the problem

$$\text{Maximize } z = 60x_1 + 30x_2 + 20x_3$$

Subject to

$$8x_1 + 6x_2 + \frac{x_3}{3} \le 48$$

$$4x_1 + 2x_2 + \frac{3}{2}x_3 \le 20$$

$$2x_1 + \frac{1}{2}x_2 + \frac{1}{2}x_3 \le 8$$

$$x_1, x_2, x_3 \ge 0$$

The optimal tableau for this problem is then (solving by Simplex Method) is:

BV	x_1	x_2	x_3	s_1	s_2	s_3	RHS
z	0	5	0	0	10	10	280
s_1	0	-2	0	1	2	-8	24
x_3	0	-2	1	0	2	-4	8
x_1	1	5/4	0	0	-1/2	3/2	2

Now, find the optimal solution using sensitivity analysis for the following changes to the original problem: **(10 points each)**

(a) Available resources change to $\begin{bmatrix} 48 \\ 30 \\ 8 \end{bmatrix}$.

(b) Prices of table changed to $33.

(c) Prices change to $60 per desk, $45 per table and $30 per chair.

(d) Suppose, due to market requirements, the total number of products made by the company should be at most 12. (Sum of all products is ≤ 12), how does that affect the optimal solution?

(e) Considering making new footstools, the price of each footstool is $15 and requires 1 board foot of lumber, 1 finishing hour and 1 carpentry hour. What will be the optimal product mix?

(f) For what change in price of table will the current solution remain optimal?

(g) There is a decrease in supply for lumber, what is the range of change that will keep the current solution optimal?