# Dated: 27th April 27, 2022

Mohammad Ali Jinnah University

**Department of Computer Science CS2420: Operations Research Semester Spring 2022**

# Due Date: 17th May 2022 (In class) Home Work # 6

**Total Points 70**

# SENSITIVITY ANALYSIS (70 points)

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:

x1 = number of desks produced x2 = number of tables produced x3 = number of chairs produced

Following is the initial LP formulation of the problem

Maximize 𝑧 = 60𝑥1 + 30𝑥2 + 20𝑥3

Subject to

8𝑥1 + 6𝑥2 + 𝑥3 ≤ 48

3

4𝑥1 + 2𝑥2 + 2 𝑥3 ≤ 20

3 1

2𝑥1 + 2 𝑥2 + 2 𝑥3 ≤ 8

𝑥1, 𝑥2, 𝑥3 ≥ 0

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BV | 𝑥1 | 𝑥2 | 𝑥3 | 𝑠1 | 𝑠2 | 𝑠3 | RHS |
| z | 0 | 5 | 0 | 0 | 10 | 10 | 280 |
| 𝑠1 | 0 | -2 | 0 | 1 | 2 | -8 | 24 |
| 𝑥3 | 0 | -2 | 1 | 0 | 2 | -4 | 8 |
| 𝑥1 | 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)**

48

1. Available resources change to[30].

8

1. Prices of table changed to $33.
2. Prices change to $60 per desk, $45 per table and $30 per chair.
3. 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?
4. 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?
5. For what change in price of table will the current solution remain optimal?
6. There is a decrease in supply for lumber, what is the range of change that will keep the current solution optimal?