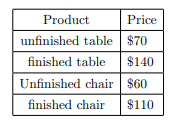
**23917-MDSC-103: Sensitivity Analysis**

**Imagine a furniture company that makes tables and chairs. A table requires 40 board feet of wood and a chair requires 30 board feet of wood. Wood costs $1 per board foot and 40,000 board feet of wood are available. It takes 2 hours of skilled labour to make an unfinished table or an unfinished chair. Three more hours of labour will turn an unfinished table into a finished table; two more hours of skilled labour will turn an unfinished chair into a finished chair. There are 6000 hours of skilled labour available. (Assume that you do not need to pay for this labour.) The prices of output are given in the table below:**



**Q1) Formulate an LP:**

Ans) x1 = number of unfurnished tables

x2 = number of furnished tables

x3 = number of unfurnished chairs

x4 = number of furnished chairs

Maximize z = 70x1 + 140x2 + 60x3 + 110x4

subject to:

40x1 + 40x2 + 30x3 + 30x4 ≤ 40000.

2x1 + 5x2 + 2x3 + 4x4 ≤ 6000.

**Optimal Solutions:** x1 = 0, x2 = 0, x3=0, x4 = 1333.333 and z = 146666.7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | x1 | x2 | x3 | x4 |  |  |  |
| Z | 70 | 140 | 60 | 110 |  |  |  |
|  | 0 | 0 | 0 | 1333.333 | 146666.7 |  |  |
|  |  |  |  |  |  |  |  |
| Subj to: |  |  |  |  |  |  |  |
|  | 40 | 40 | 30 | 30 | 40000 | <= | 40000 |
|  | 2 | 5 | 2 | 4 | 5333.333 | <= | 6000 |
|  |  |  |  |  |  |  |  |

**Sensitivity Report:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable Cells | | |  |  |  |  |  |
|  |  |  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |
|  | $D$10 | x1 | 0 | -76.66666667 | 70 | 76.66666667 | 1E+30 |
|  | $E$10 | x2 | 0 | -6.666666667 | 140 | 6.666666667 | 1E+30 |
|  | $F$10 | x3 | 0 | -50 | 60 | 50 | 1E+30 |
|  | $G$10 | x4 | 1333.333333 | 0 | 110 | 1E+30 | 5 |
|  |  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |  |
|  |  |  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |
|  | $H$13 |  | 40000 | 3.666666667 | 40000 | 5000 | 40000 |
|  | $H$14 |  | 5333.333333 | 0 | 6000 | 1E+30 | 666.6666667 |

**Q2) What would happen if the price of unfinished chairs went up?**

Ans) There will not be any effect in the optimum solution for the price of unfinished chairs till $110.

**Q3) What would happen if the price of unfinished tables went up?**

Ans) There will not be any effect in the optimum solution for the price of unfinished tables till $146.66666667.

**Q4) What if the price of finished chairs fell to $100?**

Ans) The optimum solution will decrease (The value of z will decrease). Since the optimal solution in depending on x4 and the remaining variables x1, x2, x3 are 0.

**Q5) How would profit change if lumber supplies changed?**

Ans) For increase of every unit of lumber, you will earn $3.66667 extra. Since the cost of 1 lumber is $1 therefore you will get $2.66667 extra profit.

**Q6) How much would you be willing to pay an additional carpenter?**

Ans) Since we are not paying for carpenter that means there is no use of paying extra amount.

**Q7) Suppose that industrial regulations complicate the finishing process, so that it takes one extra hour per chair or table to turn an unfinished product into a finished one. How would this change your plans?**

Ans) From the Sensitivity Report, we can say that there is no Shadow Price Increase of hours means there is no extra profit and it will decrease the profit. Since it takes extra hour that means some better quality product is produced therefore we can increase the selling price of the chair or table to get better profit.