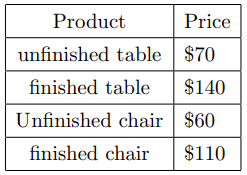
**MDSC-103**

**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:

1. **Formulate an LP that describes the production plans that the firm can use to maximize its profits.**

**Write:**

**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.**

Solution after formulating the problem:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **UT** | **FT** | **UC** | **FC** |  | **asdka** |  |
|  | 0 | 0 | 0 | 1333.333 |  |  |  |
| z | 70 | 140 | 60 | 110 | 146666.667 |  |  |
| WOOD | 40 | 40 | 30 | 30 | 40000 |  | 40000 |
| LABOR | 2 | 5 | 2 | 4 | 5333.33333 |  | 6000 |

**Sensitivity Report:**

**Variables:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |
| **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |
| UT | 0 | -76.66666667 | 70 | 76.66666667 | 1E+30 |
| FT | 0 | -6.666666667 | 140 | 6.666666667 | 1E+30 |
| UC | 0 | -50 | 60 | 50 | 1E+30 |
| FC | 1333.333333 | 0 | 110 | 1E+30 | 5 |
|  |  |  |  |  |  |
| **Constraints:** |  |  |  |  |  |
|  |  |  |  |  |  |
|  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |
| **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |
| WOOD | 40000 | 3.666666667 | 40000 | 5000 | 40000 |
| LABOUR | 5333.333333 | 0 | 6000 | 1E+30 | 666.6666667 |

1. **What would happen if the price of unfinished chairs went up?**

Price of the unfinished chairs can go $50 more without changing the current optimal solution.

This we can conclude from allowed increase.

1. **What would happen if the price of unfinished tables went up?**

Price of the unfinished chairs can go $50 more without changing the current optimal solution. This we can conclude from allowed increase.

1. **What if the price of finished chairs fell to $100?**

If the price of the finished chair falls to $100 the optimal solution will not remain same.

1. **How would profit change if lumber supplies changed?**

For every foot of lumber, you add you get $2.666666667 profit.

$3.666666667 - $1 **(lumber price)** = $2.666666667

1. **How much would you be willing to pay an additional carpenter?**

Shadow price of the labour is $0, so adding an extra carpenter will not be of any use.  
We would be willing to pay $0 for an additional carpenter.

1. **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?**
2. **The owner of the firm comes up with a design for a beautiful hand-crafted cabinet. Each cabinet requires 250 hours of labour (this is 6 weeks of full time work) and uses 50 board feet of lumber. Suppose that the company can sell a cabinet for $200, would it be worthwhile?**