**(A)** 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:

Product Price

unfinished table = $70

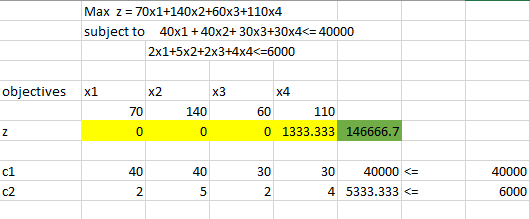
finished table = $140

Unfinished chair = $60

finished chair = $110

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.

**Ans:**



**Sensitivity Report**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable Cells | | |  |  |  |  |  |
|  |  |  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |
|  | $B$9 | z x1 | 0 | -76.66666667 | 70 | 76.66666667 | 1E+30 |
|  | $C$9 | z x2 | 0 | -6.666666667 | 140 | 6.666666667 | 1E+30 |
|  | $D$9 | z x3 | 0 | -50 | 60 | 50 | 1E+30 |
|  | $E$9 | z x4 | 1333.333333 | 0 | 110 | 1E+30 | 5 |
|  |  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |  |
|  |  |  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |
|  | $F$11 | c1 | 40000 | 3.666666667 | 40000 | 5000 | 40000 |
|  | $F$12 | c2 | 5333.333333 | 0 | 6000 | 1E+30 | 666.6666667 |

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

**Ans:**

There is no change in optimal solution if we increase the price in unfinished chairs, until the price is less than 110.By using sensitivity report we can say.

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

**Ans:**

There is no change in optimal solution if we increase the price in unfinished tables, until the price is less than 146. By using sensitivity report we can say.

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

**Ans:** The optimal solution will decrease since the optimal solution is depending on X4(finished chairs).

***(5) How would profit change if lumber supplies changed?***

**Ans:** For increase of every unit of lumber we can earn 3.66$ extra, since the cost of 1 unit of lumber is 1$ so profit is 2.66$.

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

**Ans:** Since, we have skilled labours we cannot use the additional carpenters, so we don’t need to pay anything to additional carpenter.

***(7) 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 so there is no extra profit and it even decrease the profit. To increase the profit we need to increase the price since we are taking extra hour that gives some better quality product is produced we can increase.