**Assignment**

A) x1 = # of finished table

x2 = # of finished chair

x3 = # of unfinished table

x4 = # of unfinished chair

**Answer Report**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Objective Cell (Max) | | | |  |  |  |
|  | **Cell** | **Name** | **Original Value** | **Final Value** |  |  |
|  | $I$3 | z Optimum | 182000 | 182000 |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Variable Cells | | |  |  |  |  |
|  | **Cell** | **Name** | **Original Value** | **Final Value** | **Integer** |  |
|  | $C$4 | soln x1 | 800 | 800 | Contin |  |
|  | $D$4 | soln x2 | 0 | 0 | Contin |  |
|  | $E$4 | soln x3 | 1000 | 1000 | Contin |  |
|  | $F$4 | soln x4 | 0 | 0 | Contin |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |
|  | **Cell** | **Name** | **Cell Value** | **Formula** | **Status** | **Slack** |
|  | $H$6 | M1 | 40000 | $H$6<=$J$6 | Binding | 0 |
|  | $H$7 | M2 | 6000 | $H$7<=$J$7 | Binding | 0 |

**Sensitivity Report**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable Cells | | |  |  |  |  |  |
|  |  |  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |
|  | $C$4 | soln x1 | 800 | 0 | 140 | 35 | 2.5 |
|  | $D$4 | soln x2 | 0 | -2 | 110 | 2 | 1E+30 |
|  | $E$4 | soln x3 | 1000 | 0 | 70 | 1E+30 | 14 |
|  | $F$4 | soln x4 | 0 | -66.5 | 0 | 66.5 | 1E+30 |
|  |  |  |  |  |  |  |  |
| Constraints | | |  |  |  |  |  |
|  |  |  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |
|  | $H$6 | M1 | 40000 | 0.35 | 40000 | 80000 | 40000 |
|  | $H$7 | M2 | 6000 | 28 | 6000 | 1E+30 | 4000 |

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

**Answer:**

L-P Problem :

Let, x1 = # of finished table

x2 = # of finished chair

x3 = # of unfinished table

x4 = # of unfinished chair

then we need to,

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

subject to

0x1 + 0x2 + 40x3 + 30x4 <= 40000

3x1 + 2x2 + 2x3 + 2x4 <= 6000

Where, x1, x2, x3, x4 >= 0

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

**Answer:** Even if the price of unfinished chairs went up, the optimum solution remains same.

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

**Answer:** Price of unfinished tables can be increased to 1E+30. This is **Excel's way of showing infinity**. This means that the price can be increased any amount without changing the shadow price. Hence, increasing the price of unfinished tables, will increase the profit.

4)what if the price of finished chairs fell to $100?

**Answer:** If the price of finished chairs is reduced to $10, then also the optimum solution does not change.

5)How would profit change if lumber supplies changed?

**Answer:** Suppose the lumber supplies has reduced by half, that is 20,000 board feet lumber, then we face a profit of $175,000 which is $7000 **less than** the original solution of $182,000. If we double the lumber supplies then, that is 80,000 board feet lumber, we gain a profit of $196,000 which is $14,000 **more than** the original solution of $182,000.

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

**Answer:** If we can hire an additional carpenter who can work parallelly with the existing carpenter and reduces the load on him by half then, it will only take 1 hours for them to complete an unfinished table or an unfinished chair. 1.5 hrs to finished a table and 1hr to finished a unfinished chair. Assuming that we have the same 6000 hours of both the skilled labour available, then we gain a profit of **$350,000.** Hence**,** we can hire an additional carpenter and pay him 2% of the total profit to him, that is $7000.

7)Suppose that industrial regulation, 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?

**Answer:** The profits of the company decrease to **$ 140,000.** Hence, we suffer a loss of $42,000

8)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 lumber. Suppose that the company can sell a cabinet for $200, would it be worthwhile?

**Answer:** The problem then changes as  
 Maximize  
 Z= 140x1 + 110x2 + 70x3 + 60x4 + 0 x5 + 200 x6  
 Subject to,  
 0x1 + 0x2 + 40x3 + 30x4 + 50x5 + 0x6 <= 40,000  
 3x1 + 2x2 + 2x3 + 2x4 + 0 x5 + 250 x6<= 6000  
 x1, x2, x3, x4, x5, x6>= 0

Where,

x1 = # of finished table

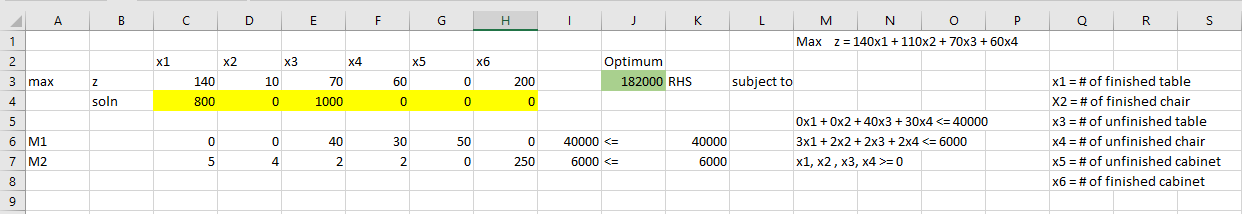
x2 = # of finished chair

x3 = # of unfinished table

x4 = # of unfinished chair

x5 = # of unfinished cabinet

x6 = # of finished cabinet

There will be not change to our optimal solution. Our optimal solution is **$182,000**