

OT Assignment 3 – Post Optimal Analysis

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

Write

x_1 = number of unfurnished tables

x_2 = number of furnished tables

x_3 = number of unfurnished chairs

x_4 = number of furnished chairs

Maximize $z = 70x_1 + 140x_2 + 60x_3 + 110x_4$

subject to

$$40x_1 + 40x_2 + 30x_3 + 30x_4 \leq 40000.$$

$$2x_1 + 5x_2 + 2x_3 + 4x_4 \leq 6000.$$

Answer:

Objective	x1	x2	x3	x4	z		
Coefficient		70	140	60	110		
Solution		0	0	0	1333.333	146666.7	
c1		40	40	30	30	40000 <=	40000
c2		2	5	2	4	5333.333 <=	6000

Variable Cells						
Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$B\$4	Solution x1	0	-76.66666667	70	76.66666667	1E+30
\$C\$4	Solution x2	0	-6.666666667	140	6.666666667	1E+30
\$D\$4	Solution x3	0	-50	60	50	1E+30
\$E\$4	Solution x4	1333.333333	0	110	1E+30	5

Constraints						
Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$F\$6	c1 z	40000	3.666666667	40000	5000	40000
\$F\$7	c2 z	5333.333333	0	6000	1E+30	666.6666667

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

Answer: The optimal solution will remain the same until the price goes up to \$110 ($60+50 = 110$). since the allowable increase in price is \$50.

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

Answer: The optimal solution will remain the same until the price goes up to \$146.666666667 ($140 + 6.666666667 = 146.666666667$) since the allowable increase in price is \$6.666666667.

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

Answer: There will be a change in the optimal solution since the allowable decrease in the price of finished chairs such that the optimal solution remains the same is only \$5.

5) How would profit change if lumber supplies changed?

Answer: Since the shadow price of the lumber supplies constraint is 3.666666667, this means that the revenue incurred from each wood is \$3.666666667. The range of values for which the profit will remain unchanged is from 0 to 45,000.

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

Answer: There's no need for an extra carpenter since we're not utilizing our labor force to its full capacity.

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?

Answer: If the finishing process is incremented by 1 unit each, then the new constraint will be $2x_1 + 6x_2 + 2x_3 + 5x_4 \leq 6000$. So, the maximum profit will change to \$140000, which seems to be somewhat lower than the previous profit made.

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

Answer: After adding the \$200 price tag in the objective function and the 50 feet of lumber and the 250 hours' time frame in the respective constraints, a profit of \$146712.3 is made. We can observe a reasonable increase in the profits incurred. Therefore, it is advisable to make the hand-crafted cabinet.