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**BUS 443 Business Analytics**

**Linear Programming Assignment 1**

**Veerman Furniture Company: Allocation Model**

Veerman Furniture Company makes three kinds of office furniture: chairs, desks, and tables. Each product requires some labor in the parts fabrication department, the assembly department, and the shipping department. The furniture is sold through a regional distributor, who has estimated the maximum potential sales for each product in the coming quarter. Finally, the accounting department has provided some data showing the profit contributions on each product. **The decision problem is to determine the product mix**; that is, to maximize Veerman’s profit for the quarter by choosing production quantities for the chairs, desks, and tables. The following data summarizes the parameters of the problem:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Department** | **Monthly Hours Available** | **Hours/Unit (Chairs)** | **Hours/Unit**  **(Desks)** | **Hours/Unit (Tables)** |
| Fabrication | 1850 | 4 | 6 | 2 |
| Assembly | 2400 | 3 | 5 | 7 |
| Shipping | 1500 | 3 | 2 | 4 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Demand Potential |  | 360 | 300 | 100 |
| Profit per unit |  | $15.00 | $24.00 | $18 |

Since we know what the model must decide the product mix, we must now ask what measure may be used to compare alternative sets of decision variables. To choose between to different product mixes, we would calculate the total profit contribution for each one and choose the higher profit. To calculate profit, we add the profit from chairs, the profit from desks, and the profit from tables. The algebraic model for total profit is:

*Profit = 15C+24D+18T*

(Where C = # of Chairs in the product mix, D = # of Desks in the product mix, and T = # of Tables in the product mix.)

To identify the constraints, we ask what restrictions limit our choice of decision variables. In this problem, we have two limitations; one due to production capacity and the other due to demand potential. A production capacity constraint states that the number of hours consumed in the fabrication department must be less than or equal to the number of hours available. This is written as:

*Fabrication hours consumed = 4C+6D+2T <= 1850 (Fabrication hours available)*

Similar constraints hold for the assembly and shipping departments:

*Assembly hours consumed = 3C+5D+7T<=2400 (Assembly hours available)*

*Shipping hours consumed = 3C+2D+4T<=1500 (Shipping hours available)*

We also require that the number of chairs produced must be less than or equal to the estimated demand potential for chairs. In symbols, we write:

*Chairs produced = C<= 360 (Chair demand potential)*

Similar constraints hold for desks and tables:

*Desks produced = D<= 300 (Desk demand potential)*

*Tables produced = T<= 100 (Table demand potential)*

We now have six constraints that describe the restrictions limiting our choice of decision variables C, D, and T. The entire model, stated in algebraic terms, reads as follows:

*Maximize z = 15C+24D+18T*

*Subject to*

*4C+6D+2T <= 1850*

*3C+5D+7T <=2400*

*3C+2D+4T <=1500*

*C <= 360*

*D <= 300*

*T <=100*

Now, we are ready to create the spreadsheet model to solve this business question. We will adopt the widely-used format for linear programs by showing variables as columns, constraints as rows, and the objective function as a special row at the top of the model. Open the **Veerman Furniture Allocation Model** spreadsheet on Moodle. We will use the SUMPRODUCT function to calculate cell results in our model. What are the maximum profit and corresponding product mix levels?