

Number 1:

a) Let X and Y be the number of units for Collegiate and Mini.

b) The management wishes to know the quantity of Collegiate and Mini to maximize the profit.

In this example, Collegiate generates a unit profit of \$32 and Mini \$24.

We can write Z as the objective/linear function:

$$Z = 32X + 24Y$$

c) There are 3 constraints in this example. One is for the square-feet of the material, one for the time of labor to produce the products, and other one for the sale per week.

For the square-feet, the sum of Collegiate and Mini are equal or smaller (\leq) than the total capacity.

For the time, the sum of the time of labor to produce both products are \leq than the total hour of labor per week. In addition, the units of both products are \leq than the sale forecasts per week. Both X and Y are bigger than zero.

d) Maximize

$$32X + 24Y$$

Subject to

$$3X + 2Y \leq 5000$$

$$45X + 40Y \leq 84000 \rightarrow 35 \text{ laborers multiply by 40 hours}$$

$$X \leq 1000$$

$$Y \leq 1200$$

$$= 1400 \text{ labor hour}$$

$$X, Y \geq 0$$

$$1400 \times 60 = 84000 \text{ min}$$

Number 2:

a) There are 3 plants with different capacities in units per day and square feet. In addition, there are products with 3 different sizes. Each product size has different profit, square feet and sale which must be considered for each plant.

Let X , Y and W be the number of units for large, medium and small sizes. All these numbers will be considered for each plant:

X_{P_1} = Number of large units at Plant 1.

X_{P_2} = " " " " Plant 2.

X_{P_3} = " " " " Plant 3.

Y_{P_1} = Number of medium units at Plant 1.

Y_{P_2} = " " " " Plant 2.

Y_{P_3} = " " " " Plant 3.

W_{P_1} = Number of small units at Plant 1.

W_{P_2} = " " " " Plant 2.

W_{P_3} = " " " " Plant 3.

b) The management wants to know the amount of production which maximize the profit:

Maximize: $Z = 420 X_{P_1} + 420 X_{P_2} + 420 X_{P_3} +$
 $360 Y_{P_1} + 360 Y_{P_2} + 360 Y_{P_3} +$
 $300 W_{P_1} + 300 W_{P_2} + 300 W_{P_3}$

Subject to

$$X_{P_1} + Y_{P_1} + W_{P_1} \leq 750$$

$$X_{P_2} + Y_{P_2} + W_{P_2} \leq 900$$

$$X_{P_3} + Y_{P_3} + W_{P_3} \leq 450$$

} Capacity of production

$$20 X_{P_1} + 15 Y_{P_1} + 12 W_{P_1} \leq 13000$$

$$20 X_{P_2} + 15 Y_{P_2} + 12 W_{P_2} \leq 12000$$

$$20 X_{P_3} + 15 Y_{P_3} + 12 W_{P_3} \leq 5000$$

} Square Feet

$$X_{P_1} + Y_{P_1} + W_{P_1} \leq 900$$

$$X_{P_2} + Y_{P_2} + W_{P_2} \leq 1200$$

$$X_{P_3} + Y_{P_3} + W_{P_3} \leq 750$$

} Sale Forecasts

$$X_{P_1}, X_{P_2}, X_{P_3}, Y_{P_1}, Y_{P_2}, Y_{P_3}, W_{P_1}, W_{P_2}, W_{P_3} \geq 0$$