64018 Assignment Module 2- The LP Model

Tammy Liu wliu16@kent.edu   Sep 12 Mon

1. Back Savers Production Tradeoff Problem

a. The decision variables are: X_1 as the number of Collegiate backpack produced and X_2 as the number of the Mini backpack produced.

b. The objective function is to maximize the total profit from the backpack production as
   Max Profit = $32X_1 + 24X_2$

c. There are three constraints as the following:
   - Total nylon available per week: $3X_1 + 2X_2 <= 5,000$
   - Total hours available from all labor per week: $45/60X_1 + 40/60X_2 <= 35$laborers*40 hours/labor/week
   - Total sold per week: $X_1 <=1,000$, $X_2 <= 1,200$

d. Full mathematical formulation
   Max Profit = $32X_1 + 24X_2$
   Subject to
   $$3X_1 + 2X_2 <= 5,000$$
   $$45/60X_1 + 40/60X_2 <= 35*40$$
   $$X_1 <=1,000, X_2 <= 1,200$$

2. The Weigelt Corp. Capacity Allocation Problem

a. Decision variables:
   L_1: number of units of large products produced in Plant 1
   L_2: number of units of large products produced in Plant 2
   L_3: number of units of large products produced in Plant 3
   M_1: number of units of medium products produced in Plant 1
   M_2: number of units of medium products produced in Plant 2
   M_3: number of units of medium products produced in Plant 3
   S_1: number of units of small products produced in Plant 1
   S_2: number of units of small products produced in Plant 2
   S_3: number of units of small products produced in Plant 3

b. LP model:

The objective function is to max profit
Max Z = $420*(L_1+L_2+L_3) +360*(M_1+M_2+M_3) +300*(S_1+S_2+S_3)$

Subject to:
Capacity constraint:
   $$L_1+M_1+S_1<= 750$$

$$L_2+M_2+S_2 <= 900$$
$$L_3+M_3+S_3 <= 450$$

Storage constraint:

$$20*L_1+15*M_1+12*S_1 <= 13{,}000$$
$$20*L_2+15*M_2+12*S_2 <= 12{,}000$$
$$20*L_3+15*M_3+12*S_3 <= 5{,}000$$

Sale constraint:

$$L_1+L_2+L_3 >= 900$$
$$M_1+M_2+M_3 >= 1{,}200$$
$$S_1+S_2+S_3 >= 750$$

Same percentage in excess capacity production:

$$(L_1+M_1+S_1):(L_2+M_2+S_2):(L_3+M_3+S_3) = 750:900:450$$

Non-negativity:

$$L_1, L_2, L_3, M_1, M_2, M_3, S_1, S_2, S_3 >= 0$$