**Linear Programming Model – Module 2**

**The Problem**

* **Company**: Back Savers backpack manufacturer.
* **Decision Variables**:
  + **Qty of each type of backpack to produce weekly**
  + **X = Collegiate Backpacks produced weekly**
  + **Y = Mini Backpacks produced weekly**
* **Objective Function**: Maximize profits for backpack sales.
  + **Maximize Z = 32X + 24Y**
    - **Where X and Y are profits produced per unit sold**
* **Constraints**:
  + **45x + 40y <= 84000min**
    - **Where X and Y are minutes per unit to produce**
  + **3X + 2Y <= 5000**
    - **Where X and Y are sqft materials per unit to produce**
  + **X <= 1000 units per week to sell**
  + **Y <= 1200 units per week to sell**
* **Non-Negativity**
  + **( X, Y) >= 0**

**Data Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Back Pack | Craft Time | Profit | Max Units | Material Required |
|
| B1 | 45min | $32 | 1000 | 3sqft |
| B2 | 40min | $24 | 1200 | 2sqft |

**Full LP Model:**

**Max Z = 32x + 24y**

**Subject to:**

**45x + 40y <= 84000 (minutes of man hours available)**

**X <= 1000 (Collegiate Bag demand limit)**

**Y <= 1200 (Mini Bag demand limit)**

**3x + 2y <= 5000 (sqft of raw material available)**

**X >= 0 (Non-negative)**

**Y >= 0 (Non-negative)**

**The Problem**

* **Company**: Weigelt Corp manufacturing.
* **Decision Variables**:
  + **Qty of each type of unit to produce per plant.**
  + **X1L+X1M+X1S = Plant 1 product produced daily**
  + **X2L+X2M+X2S = Plant 2 product produced daily**
  + **X3L+X3M+X3S = Plant 3 product produced daily**
* **Objective Function**: Maximize profits.
  + **Maximize Z = 420XiL + 360XiM +300XiS**
    - **Where Xi are profits produced per unit sold**
* **Constraints**:
  + **XiL+XiM+XiS <= Ci**
    - **Where total capacity Ci = (C1 = 750, C2 = 900, C3 = 450)**
    - **Where Xi are total units per product produced per plant**
  + **20X1L + 15X1M + 12X1S <= 13000 sqft**
  + **20X2L + 15X2M + 12X2S <= 12000 sqft**
  + **20X3L + 15X3M + 12X3S <= 5000****sqft**
    - **Where XL = 20sqft, XM = 15sqft, XS = 12sqft**
  + **X1L + X1M + X1S <= 900**
  + **X2L + X2M + X2S <= 1200**
  + **X3L + X3M + X3S <= 750**
    - **Where sales demand cannot exceed plant capacities**
  + **[X1(L+M+S)] / 750 = [X2(L+M+S] / 900 = [X3(L+M+S)] / 450**
    - **Equal percentage of capacity use**
  + **X1i/750 = X2i/900 -> 900(X1i) = 750(X2i)**
  + **X1i/750 = X3i/450 -> 450(X1i) = 750(X3i)**
    - **Where I = (XL + XM + XS) per plant**

**Non-Negativity**

* + **(Xij) >= 0**
    - **Where I = Plant #, J = Product Size**

**Full LP Model:**

**Max Z = 420XiL + 360XiM +300XiS**

**Subject to:**

**XiL+XiM+XiS <= 750, 900, 450 (Production capacity per plant)**

**20XiL + 15XiM + 12XiS <= 13000, 12000, 5000 (Storage capacity per plant)**

**XiL <= 900, XiM <= 1200, XiS <= 750 (Demand per item type)**

**X1i/750 = X2i/900 -> 900(X1i) = 750(X2i) (Equal capacity utilization)**

**X1i/750 = X3i/450 -> 450(X1i) = 750(X3i) (Equal capacity utilization)**

**Xij >= 0 (Non-Negative)**