| | | | | Available | |
|---|---|---|---|---|---|
| | Collegiate | Mini | | Collegiate | Mini |
| | | | | 1000 | 1200 |
| | | | | Max | |
| Labor Hours | 0.75 | 0.67 | | 1400 | |
| SQ Material | 3 | 2 | | 5000 | |
| | | | Total Profit | | |
| Unit Profit | $32 | $24 | | | |

Decision Variables

How much of the collegiate and mini backpacks to maximize profits.

$x_1$ - Amount of Collegiate, $x_2$ – Amount of Mini

Objective Function

Maximize Profit (Z) = $32_{x1} + 24_{x2}$

Constraints

Labor hours – ≤ 1400, SQ Material – ≤ 5000, Collegiate – ≤1000,
Mini – ≤ 1200

Mathematical Formula

Objective Function -Maximize Profit (Z)= $32_{x1} + 24_{x2}$

Subject to = $x_1 \leq 1000$

$x_2 \leq 1200$

$0.75_{x1}+0.67_{x2} \leq 1400$

$3_{x1}+2_{x2} \leq 5000$

And

$x_1 \geq 0, x_2 \geq 0$

| | SQ Feet | Excess Capacity | |
|---|---|---|---|
| Plant 1 | 1300 | 750 | |
| Plant 2 | 1200 | 900 | |
| Plant 3 | 5000 | 450 | |
| | | | |
| | Unit Profit | SQ Feet | Sold Per Day |
| Large | 420 | 20 | 900 |
| Medium | 360 | 15 | 1200 |
| Small | 320 | 12 | 750 |
| | | | |
| | Large | Medium | Small |
| Plant 1 | | | |
| Plant 2 | | | |
| Plant 3 | | | |

Decision Variables

How much of each of the sizes should be produced by each of the plants to maximize profit.

Number of Large Plant 1 – $_{x1}$

Number of Medium Plant 1 – $_{x2}$

Number of Small Plant 1 – $_{x3}$

Number of Large Plant 2 – $_{2x1}$

Number of Medium Plant 2 – $_{2x2}$

Number of Small Plant 2 – $_{2x3}$

Number of Large Plant 3 – $_{3x1}$

Number of Medium Plant 3 – $_{3x2}$

Number of Small Plant 3 – $_{3x3}$

Maximize Profit (Z) = $420_{x1} + 360_{x2} + 300_{x3} + 420_{2x1} + 360_{2x2} + 300_{2x3} + 420_{3x1} + 360_{3x2} + 300_{3x3}$

Subject to = $_{x1} + _{x2} + _{x3} \leq 750$

$_{2x1} + _{2x2} + _{2x3} \leq 900$

$_{3x1} + _{3x2} + _{3x3} \leq 450$

$20_{x1} + 15_{x2} + 12_{x3} \leq 13000$

$20_{2x1} + 15_{2x2} + 12_{3x3} \leq 12000$

$$20\ {}_{3x1} + 15\ {}_{3x2} + 12\ {}_{3x1} \leq 5000$$

$${}_{x1} + {}_{2x1} + {}_{3x1} \leq 900$$

$${}_{x2} + {}_{2x2} + {}_{3x2} \leq 1200$$

$${}_{x3} + {}_{2x3} + {}_{3x3} \leq 750$$

$$1/750({}_{x1} + {}_{x2} + {}_{x3}) - 1/900({}_{2x1} + {}_{2x2} + {}_{2x1}) = 0$$

$$1/750({}_{x1} + {}_{x2} + {}_{x3}) - 1/450({}_{3x1} + {}_{3x2} + {}_{3x3}) = 0$$

And

$${}_{x1} \geq 0,\ {}_{x2} \geq 0,\ {}_{x3} \geq 0,\ {}_{2x1} \geq 0,\ {}_{2x2} \geq 0,\ {}_{2x3} \geq 0,$$

$${}_{3x1} \geq 0,\ {}_{3x2} \geq 0,\ {}_{3x3} \geq 0.$$