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**Quantitative Management Modeling**

**BA-64018-001**

**Assignment: Module 2 – The LP Model**

**1a. Clearly define the decision variables:**

The decision variables are the quantities of each backpack model that Back Savers should produce per week.

* = number of Collegiate backpacks produced per week (units)
* = number of Mini backpacks produced per week (units)

**1b. What is the objective function?**

The objective function represents Back Savers’ goal, which is to maximize profit.

* Each Collegiate yields $32 profit per unit.
* Each Mini yields $24 profit per unit.

So, the objective function is:

**1c. What are the constraints?**

Fabric availability:

* Collegiate uses 3 sq ft., Mini uses 2 sq. ft.
* Maximum availability = 5,000 sq. ft.

Labor availability:

* Each Collegiate = 45 minutes
* Each Mini = 40 minutes
* Labor available = 35 workers × 40 hours/week × 60 min/hour = 84,000 minutes total

Sales limits:

* Cannot sell more than 1000 Collegiates.
* Cannot sell more than 1200 Minis.

Non-negativity:

**1d. Write down the full mathematical formulation for this LP problem.**

(Material)

(Labor)

(Sales limit for Collegiates)

(Sales limit for Minis)

(Non-negativity)

**2a. Define the decision variables**

* = units of **Large** produced at Plant 1 per day
* = units of **Medium** produced at Plant 1 per day
* = units of Small produced at Plant 1 per day
* ​ = units of **Large** produced at Plant 2 per day
* = units of **Medium** produced at Plant 2 per day
* = units of **Small** produced at Plant 2 per day
* = units of **Large** produced at Plant 3 per day
* = units of **Medium** produced at Plant 3 per day
* = units of **Small** produced at Plant 3 per day

**2b. Formulate a linear programming model for this problem.**

**Objective Function**  
Maximize total daily profit:

Max Z = 420+ 360(+ 300(

**Constraints**

1. Equal percentage of plant capacity used:

1. Plant storage limits (ft²/day):

1. Sales limits:

(Large)  
(Medium)  
(Small)

1. Nonnegativity: