1. Back Savers is a company that produces backpacks primarily for students. They are considering offering some combination of two different models—the Collegiate and the Mini. Both are made out of the same rip-resistant nylon fabric. Back Savers has a long-term contract with a supplier of the nylon and receives a 5000 square-foot shipment of the material each week. Each Collegiate requires 3 square feet while each Mini requires 2 square feet. The sales forecasts indicate that at most 1000 Collegiates and 1200 Minis can be sold per week. Each Collegiate requires 45 minutes of labor to produce and generates a unit profit of $32. Each Mini requires 40 minutes of labor and generates a unit profit of $24. Back Savers has 35 laborers that each provides 40 hours of labor per week. Management wishes to know what quantity of each type of backpack to produce per week.
    a. Clearly define the decision variables
    b. What is the objective function?
    c. What are the constraints?
    d. Write down the full mathematical formulation for this LP problem.

A.Define the decision variable

Let x be no. of collegiates

Let y be no of Minis

B. Objective function

To Maximize total no. Of Collegiates and Minis

Profit per collegiate is$32

Profit per Minis is$ 24

Z = 32x+24y

C. Constraints

Nylon : 5000 sq ft per week

Collegiates = 3sq ft

Minis = 2sq ft

⇨ Nylon : 3x+2y <= 5000

Time

Collegiates require 45 min.

Minis require 40 min

Each labour works for 40 hr/week = 2400min

We have 35 labour so total min = 2400*35 84000

- Time : 45x+40y<=84000

Sales Forecast

Collegiates forecast indicates 1000

Minis forecast 1200

- x<= 1000
- y <= 1200

Mathematical formulation

Z = 32x+24y
Nylon : 3x+2y <= 5000
Time : 45x+40y<=84000

- x<= 1000
- y <= 1200

x>=0 , y >=0