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 from 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.

1. **Clearly define the decision variables**

X and Y are the decision variables - X represents collegiate and Y is Mini

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

The main objective function is to maximize the profit of the company,

Profit P = 32X + 24Y

1. **What are the constraints?**

Back Saver sells Collegiate and Mini. Let’s say Collegiate is X and Mini is Y.

Each Collegiate requires 3sft and Mini required 2sft and Back Savers receives 5000sft material each week, i.e,

3X+2Y <= 5000

Collegiate produces 32$ profit and required 45 minutes labor.

Mini produces 24$ profit and required 40 minutes labor

Profit P = 32X + 24Y

Total labor required is (45X + 40Y) minutes

Available labor is 35\*40 = 1400hours

= 84000 minutes

i.e.,45X + 40Y <= 84000 minutes per week.

Sales forecasts indicate that at most 1000 Collegiates and 1200 Minis can be sold per week

X<= 1000

Y<= 1200

And Variables must be greater than 0,

X,Y >= 0

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

P = 32X + 24Y

3x+2y <= 5000

45x + 40y <= 84000 minutes per week

X<= 1000

Y<= 1200