

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.

Ans.

Total Nylon sheet in square-foot- 5000

Total working time in minutes-84000

a. Decision Variables- Collegiate(X) & Mini(Y)

b. Objective function for profit maximization (Z) = $32X + 24Y$

c. Constraints- $X \leq 1000$

$Y \leq 1200$

d. Mathematical formulation- $3X + 2Y \leq 5000$

$45X + 40Y \leq 84000$

$X, Y \geq 0$