1.

a. The decision variables are: X_1 & X_2 Representing the activity of producing the Mini and Collegiate models of backpack.

b. The objective function is: Maximize $Z = 32X_1 + 24X_2$. Where 32 is the profit per Collegiate and 24 is the profit per mini.

c. There are several constraints:

   i. The constraints on fabric: $3X_1 + 2X_2 \leq 5000$. Each Collegiate uses 3 square feet of material, each mini uses 2 square feet of material. The total amount of material available is 5000 square feet.

   ii. Sales forecast constraints: $X_1 \leq 1000$ & $X_2 \leq 1200$. These are the maximum number of forecasted sales per backpack model.

   iii. Labor constraints: There are 35 laborers each providing 40 hrs per week of labor. Each Collegiate takes 45 minutes to complete and Each Mini takes 40 minutes to complete. Converting everything into hours and totaling the available labor we have the following constraint. $3/4X_1 + 2/3X_2 \leq 1400$

d. Maximize $Z = 32X_1 + 24X_2$

   Subject to the restrictions:

   i. $3X_1 + 2X_2 \leq 5000$

   ii. $X_1 \leq 1000$ & $X_2 \leq 1200$

   iii. $3/4X_1 + 2/3X_2 \leq 1400$

2.

A. The decision variables are: X_1 X_2 & X_3. They represent the amount of the small, medium, and large size of the product to be produced.

B. Maximize $Z = 420X_1 + 360X_2 + 300X_3$

Subject to the constraints:

$X_1 \leq 750$ (Production Capacity)

$X_2 \leq 900$ (Production Capacity)

$X_3 \leq 450$ (Production Capacity)

Storage Space Constraints

$20X_1 + 15X_2 + 12X_3 \leq 13{,}000$ (Space Warehouse 1)

$20X_1 + 15X_2 + 12X_3 \leq 12{,}000$ (Space Warehouse 2)

$20X_1 + 15X_2 + 12X_3 \leq 5{,}000$ (Space Warehouse 3)

Sales Constraints

$X_1 \leq 900$

$X_2 \leq 1200$

$X_3 \leq 750$