

### Solution for the Problem – 1:

The company offers two different models of backpacks. Those are ....

1. Collegiate
2. Mini

Let's assume

No of Collegiate Bags = C

No of Mini Bags = M

Bag-Model	Material Required (Sq. Ft)	Sales per week	Labor Work (Min)	Profit per week
Collegiate	3	1000	45	32
Mini	2	1200	40	24

The size of the material shipment per week = 5000 Sq. Ft

Let Z represented as the Objective Function for Maximum Profit.

$$Z = 32C + 24M \rightarrow (\text{Objective Function})$$

Constraints are a combination of Labor work and Material.

$$3C + 2M \leq 5000 \rightarrow (\text{Material Constraint})$$

Let convert minutes into hours

$$45/60C + 40/60M \leq 40 \times 35$$

$$3/4C + 2/3M \leq 1400 \rightarrow (\text{Labor work Constraint in Hours})$$

Non-Negativity Condition of decision Variable

$$0 \leq C \leq 1000$$

$$0 \leq M \leq 1200$$

**Solution for Problem – 2:****Formulation of Data into a tabular form:**

	<b>Capacity</b>	<b>Space (Sq. Ft)</b>
Plant - 1	750	13000
Plant - 2	900	12000
Plant - 3	450	5000

	<b>Profit</b>	<b>Material Required</b>	<b>Sales</b>
Large	\$420	20	900
Medium	\$360	15	1200
Small	\$300	12	750

**Objective Function: For Maximum Profit:**

$$N = 420(P_1L + P_1M + P_1S) + 360(P_2L + P_2M + P_2S) + 300(P_3L + P_3M + P_3S)$$

P is the No of units produced.

P<sub>1</sub> is No. of units produced in plant 1

P<sub>2</sub> is No. of units produced in plant 2

P<sub>3</sub> is No. of units produced in plant 3

**Constraints of Capacity:**

$$P_1L + P_1M + P_1S \leq 750$$

$$P_2L + P_2M + P_2S \leq 900$$

$$P_3L + P_3M + P_3S \leq 450$$

**Constraints of Storage Space**

$$20P_1L + 15P_1M + 12P_1S \leq 13000$$

$$20P_2L + 15P_2M + 12P_2S \leq 12000$$

$$20P_3L + 15P_3M + 12P_3S \leq 5000$$

**Constraints of Sales forecasts**

$$P_1L+P_2L+P_3L\leq 900$$

$$P_1M+P_2M+P_3M\leq 1200$$

$$P_1S+P_2S+P_3S\leq 750$$

The percentage of excess capacity usage of each plant is equal to

$$\frac{P_1L+P_1M+P_1S}{750} 100 = \frac{P_2L+P_2M+P_2S}{900} 100 = \frac{P_3L+P_3M+P_3S}{450} 100$$