Problem - 1 → Back Savers Company

Data Provided:

Area required per each

Collegiate	- C	3 sq ft
Minis	- M	2 sq ft

Forcasted number of backpacks sold

Collegiate	1000
Minis	1200

Time taken to manufacture

Collegiate	45 mins
Minis	40 mins

Profit generated per each mini

Collegiate	$32
Mini	$24

Let C be the number of Collegiates
    M be the number of Minis

Objective of the Problem

Maximizing the profit (X)

$$X = 32C + 24M$$

Constraint:

Time Constraints:

The workers require minimum time to produce in a week

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

$$\Rightarrow 45C + 40M \leq 84000$$

Material:

The company receives maximum of 5000 sq ft of material to manufacture the products

$$\Rightarrow 3C + 2M \leq 5000$$

$$C \leq 1000$$
$$M \leq 1200$$

non negativity

$$C \geq 0$$
$$M \geq 0$$

Problem-2 — Weigelt Corporation

Data Provided

→ The company has 3 plants

→ It manufactures a new product in 3 sizes.

Net profit of each size

Large	-	$ 420
Medium	-	$ 360
Small	-	$ 300

Capacity of plants

Plant -1	750
Plant -2	900
Plant -3	450

Storage space of each of the plants

Plant -1	13,000
Plant -2	12,000
Plant -3	5,000

Space taken by the produce

Large - 20   Small - 12

Medium - 15

Forcasted number of units sold

Large	900
Medium	1200
Small	700

Changing into Polynomial form

Let X_{nm} be the variable

where n is the size of the product
$$\Rightarrow \quad n = 1 \quad \Rightarrow \quad large$$
$$n = 2 \quad \Rightarrow \quad medium$$
$$n = 3 \quad \Rightarrow \quad small$$

and m is the name of the plants
$$m = 1 \quad \Rightarrow \quad plant\ 1$$
$$m = 2 \quad \Rightarrow \quad plant\ 2$$
$$m = 3 \quad \Rightarrow \quad plant\ 3$$

Solving the problem

→ Defining the objective of the problem

The objective of the problem is to maximize the six profit by understand the number of units that noed to be produced.

Constraints:

$$= 420\left(X_{11} + X_{12} + X_{13}\right) + 360\left(X_{21} + X_{22} + X_{23}\right)$$
$$+ 300\left(X_{31} + X_{32} + X_{33}\right)$$

Constraints:

Time constraint:

Each of the plant cannot produce more than the provided number of units in a day.

$$X_{11} + X_{21} + X_{31} \leq 750$$

$$X_{12} + X_{22} + X_{32} \leq 900$$

$$X_{13} + X_{23} + X_{33} \leq 450$$

Also given that the number of units for each size in all the three plants cannot be more than the given values.

$$X_{11} + X_{12} + X_{13} \leq 900$$

$$X_{21} + X_{22} + X_{23} \leq 1200$$

$$X_{31} + X_{32} + X_{33} \leq 750$$

Space Constraints

$$20\,X_{11} + 15\,X_{21} + 12\,X_{31} \leq 13,000$$

$$20\,X_{12} + 15\,X_{22} + 12\,X_{32} \leq 12600$$

$$20\,X_{13} + 15\,X_{23} + 12\,X_{33} \leq 5000$$

It is mentioned that each of the plant have to produce same percentage.

$$\frac{(X_{11} + X_{21} + X_{31})}{750} = \frac{X_{12} + X_{22} + X_{32}}{900} = \frac{X_{13} + X_{25} + X_{33}}{450}$$

$$X_{11}, X_{12}, X_{13}, X_{21}, X_{22}, X_{23}, X_{31}, X_{32}, X_{33} \geq 0$$