

MODULE 2 - THE LP MODEL

2. COMPANY - WEIGELT CORPORATION

PRODUCT
 • LARGE - \$420
 • MEDIUM - \$260 ← PROFIT
 • SMALL - \$100

PLANT
 PLANT 1 - 750 ← CAPACITY PER DAY
 PLANT 2 - 900
 PLANT 3 - 450

SALES FORECAST
 900 - LARGE ← PER DAY
 1200 - MEDIUM
 750 - SMALL

PLANT STORAGE SPACE
 PLANT 1 = 17,000 SQ
 PLANT 2 = 12,000 SQ
 PLANT 3 = 5,000 SQ

* MAXIMUM PROFIT

EACH UNIT REQUIRES

20 SQ - LARGE

15 SQ - MEDIUM

12 SQ - SMALL

A. DECISION VARIABLES

X_{ij} = NUMBER OF UNITS OF PRODUCT SIZE

$i = 1, 2, 3 \leftarrow$ PLANTS

$j = 1, 2, 3 \leftarrow$ LARGE, MEDIUM, SMALL

Ex: X_{11} = NUMBER OF LARGE AT PLANT 1

X_{12} = NUMBER OF MEDIUM PLANT 1

X_{13} = NUMBER OF SMALL PLANT 1

B. OBJECTIVE FUNCTION

$$Z = 420(X_{11} + X_{12} + X_{13}) + 360(X_{21} + X_{22} + X_{23}) + 100(X_{31} + X_{32} + X_{33})$$

\downarrow \uparrow
 LARGE MEDIUM SMALL
 PROFIT PROFIT PROFIT

SAME PERCENTAGE USE

$$\frac{X_{11} + X_{12} + X_{13}}{750} = \frac{X_{21} + X_{22} + X_{23}}{900} = \frac{X_{31} + X_{32} + X_{33}}{450}$$

\downarrow \downarrow \downarrow
 SALES FORECAST SALES FORECAST SALES FORECAST

D. FULL EQUATION

MAXIMIZE

$$\frac{X_{11} + X_{12} + X_{13}}{750} = \frac{X_{21} + X_{22} + X_{23}}{900} = \frac{X_{31} + X_{32} + X_{33}}{450}$$

$$20X_{11} + 15X_{12} + 12X_{13} \leq 17,000$$

$$20X_{21} + 15X_{22} + 12X_{23} \leq 12,000$$

$$20X_{31} + 15X_{32} + 12X_{33} \leq 5,000$$

$$X_{11} + X_{21} + X_{31} \leq 900$$

$$X_{12} + X_{22} + X_{32} \leq 1,200$$

$$X_{13} + X_{23} + X_{33} \leq 750$$

$$X_{ij} \geq 0$$

C. CONSTRAINTS

STORAGE CONSTRAINTS

$$20X_{11} + 15X_{12} + 12X_{13} \leq 17,000 \leftarrow \text{PLANT 1}$$

$$20X_{21} + 15X_{22} + 12X_{23} \leq 12,000 \leftarrow \text{PLANT 2}$$

$$20X_{31} + 15X_{32} + 12X_{33} \leq 5,000 \leftarrow \text{PLANT 3}$$

DEMAND CONSTRAINTS

$$X_{11} + X_{21} + X_{31} \leq 900 \text{ LARGE}$$

$$X_{12} + X_{22} + X_{32} \leq 1,200 \text{ MEDIUM}$$

$$X_{13} + X_{23} + X_{33} \leq 750 \text{ SMALL}$$

NON-NEGATIVITY CONSTRAINTS

$$X_{ij} \geq 0$$