MODULE 2 - THE LP MODEL

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1. COMPANY - (BLACK SAVERS)

- COLLEGIATE
- MINI

← MADE FROM RIP RESISTANT NYLON FABRIC →

BLACK SAVERS CONTRACT

- NYLON - 5000 SQ EACH WEEK

↓

COLLEGIATE REQUIRES 3 SF

MINI 2 SF

SALES FORCAST

1,000 COLLEGIATE

1,200 MINI

CAN BE SOLD PERWEEK

LABOR

EACH COLLEGIATE REQUIRES 45 MIN TO MAKE - $ 32 PROFIT

EACH MINI REQUIRES 40 MIN - $24 PROFIT

35 LABORS = 40 HOURS

MANAGMENT WISHES TO KNOW WHAT QUANTY TO PRODUCE

A. DECISION VARIABLES

COLLEGIATE = X_1

MINI = X_2

→

B. OBJECTIVE FUNCTION

MAXIMIZE

$Z = 32x_1 + 24x_2$

$ 32 PROFIT

$ 24 PROFIT

C. CONSTRAINTS

MATERIAL (NYLON) - 5,000 SQ PER WEEK

$3x_1 + 2x_2 \leq 5000$

COLLEGIATE MINI

SALES CONSTRAINTS

$x_1 \leq 1{,}000$ COLLEGIATE

$x_2 \leq 1{,}200$ MINI

← CAN BE SOLD PER WEEK

LABOR CONSTRAINTS

35 LABORS x 40 HOURS = 1400 HOURS

1400 HOURS x 60 = $ 4,000 MIN

$45x_1 + 40x_2 \leq 84.000$ MIN

↓ COLLEGIATE ↓ MINI

D. FULL EQUATION

MAXIMIZE $Z = 32x_1 + 24x_2$

$3x_1 + 2x_2 \leq 5000$

$45x_1 + 40x_2 \leq 84,000$

$x_1 \leq 1,000$

$x_2 \leq 1200$

$x1 \geq 0$

$x2 \geq 0$

NON-NEGATIVE

$x1 \geq 0$

$x_2 \geq 0$

MODULE 2 - THE LP MODEL

2. COMPANY - WEIGELT CORPORATION

PRODUCT
- LARGE - $420
- MEDIUM - $360
- SMALL - $300

← PROFIT

PLANT
PLANT 1 - 750
PLANT 2 - 900
PLANT 3 - 450

← CAPACITY PER DAY

SALES FORCAST
900 - LARGE
1200 - MEDIUM
750 - SMALL

← PER DAY

PLANT STORAGE SPACE
PLANT 1 = 13,000 SQ
PLANT 2 = 12,000 SQ
PLANT 3 = 5,000 SQ

↓

EACH UNIT REQUIRES
20 SQ - LARGE
15 SQ - MEDIUM
12 SQ - SMALL

☆ MAXIMUM PROFIT

A. DECISION VARIABLES

X = NUMBER OF UNITS OF PRODUCT SIZE

$I = 1, 2, 3$ ← PLANTS

$J = 1, 2, 3$ ← LARGE, MEDIUM, SMALL

Ex: X_{11} = NUMBER OF LARGE AT PLANT 1
X_{12} = NUMBER OF MEDIUM PLANT 1
X_{32} = NUMBER OF MEDIUM PLANT 3

B. OBJECTIVE FUNCTION

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

420 ↓ LARGE PROFIT
360 ↓ MEDIUM PROFIT
300 ↑ SMALL PROFIT

↓

SAME PERCENTAGE USE

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

750 ↓ SALES FORCAST
900 ↙
450 ←

C. CONSTRAINTS

STORAGE CONSTRAINT

$20X_{11} + 15X_{12} + 12X_{13} \leq 13{,}000$ ← PLANT 1
$20X_{21} + 15X_{22} + 12X_{23} \leq 12{,}000$ ← PLANT 2
$20X_{31} + 15X_{32} + 12X_{33} \leq 5{,}000$ ← PLANT 3

DEMAND CONSTRAINTS

$X_{11} + X_{21} + X_{31} \leq 900$ LARGE
$X_{12} + X_{22} + X_{32} \leq 1200$ MEDIUM
$X_{13} + X_{23} + X_{33} \leq 750$ SMALL

NON-NEGATIVITY CONSTRAINTS

$X_{IJ} \geq 0$

D. FULL EQUATION

MAXIMIZE

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

$20X_{11} + 15X_{12} + 12X_{13} \leq 13{,}000$
$20X_{21} + 15X_{22} + 12X_{23} \leq 12{,}000$
$20X_{31} + 15X_{32} + 12X_{33} \leq 5{,}000$

$X_{11} + X_{21} + X_{31} \leq 900$
$X_{12} + X_{22} + X_{32} \leq 1{,}200$
$X_{13} + X_{23} + X_{33} \leq 750$

$X_{IJ} \geq 0$