

LP Problem

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Writing Linear Programming Problem

Objective

$$\text{Max} = 420(AI + BI + CI) + 360(Am + Bm + Cm) + 300(As + Bs + Cs)$$

Production Constraint

$$AI + Am + As \leq 750$$

$$BI + Bm + Bs \leq 900$$

$$CI + Cm + Cs \leq 450$$

Storage Constraint

$$20AI + 15Am + 12As \leq 13000$$

$$20BI + 15Bm + 12Bs \leq 12000$$

$$20CI + 15Cm + 12Cs \leq 5000$$

Sales Constraint

$$AI + BI + CI \leq 900$$

$$Am + Bm + Cm \leq 1200$$

$$As + Bs + Cs \leq 750$$

Same Ratio Constraint

$$Al + Am + As / 750 = Bl + Bm + Bs / 900 = Cl + Cm + Cs / 450$$

Loading required libraries

```
library(lpSolve)
```

Coefficients and constraint matrix

```
coeff = c(420,360,300,420,360,300,420,360,300)

mat = matrix(c(1, 0, 0, 1, 0, 0, 1, 0, 0,
               0, 1, 0, 0, 1, 0, 0, 1, 0,
               0, 0, 1, 0, 0, 1, 0, 0, 1,
               1, 1, 1, 0, 0, 0, 0, 0, 0,
               0, 0, 0, 1, 1, 1, 0, 0, 0,
               0, 0, 0, 0, 0, 0, 1, 1, 1,
               20, 15, 12, 0, 0, 0, 0, 0, 0,
               0, 0, 0, 20, 15, 12, 0, 0, 0,
               0, 0, 0, 0, 0, 0, 20, 15, 12,
               900, 900, 900, -750, -750, -750, 0, 0, 0,
               0, 0, 0, 450, 450, 450, -900, -900, -900,
               450, 450, 450, 0, 0, 0, -750, -750, -750),
             nrow=12,
             byrow=TRUE)
```

Directions of constraints and RHS constraints

```
dir = c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=", "=", "=", "=")

RHS = c(900,1200,750,750,900,450,13000,12000,5000,0,0,0)
```

Solving the problem

```
X = lp("max", coeff, mat, dir, RHS)
```

Displaying output values

```
cat("Optimal Profit (P):\n")
```

```
## Optimal Profit (P):
```

```
print(X$objval)
```

```
## [1] 696000
```

```
cat("Optimal Solution (Al, Am, As, Bl, Bm, Bs, Cl, Cm, Cs):\n")
```

```
## Optimal Solution (Al, Am, As, Bl, Bm, Bs, Cl, Cm, Cs):
```

```
X$solution[1]
```

```
## [1] 516.6667
```

```
X$solution[2]
```

```
## [1] 177.7778
```

```
X$solution[3]
```

```
## [1] 0
```

```
X$solution[4]
```

```
## [1] 0
```

```
X$solution[5]
```

```
## [1] 666.6667
```

```
X$solution[6]
```

```
## [1] 166.6667
```

```
X$solution[7]
```

```
## [1] 0
```

```
X$solution[8]
```

```
## [1] 0
```

```
X$solution[9]
```

```
## [1] 416.6667
```

Quantity of products to be manufactured at
Plant Al, Am, As:

Plant 1:

$Al = 516.6667$

$Am = 177.7778$

$As = 0$

Quantity of products to be manufactured at
Plant Bl, Bm, Bs:

Plant 2:

$Bl = 0$

$Bm = 666.6667$

$Bs = 166.6667$

Quantity of products to be manufactured at
Plant Cl, Cm, Cs:

Plant 3:

$$Cl = 0$$

$$Cm = 0$$

$$Cs = 416.6667$$