Linear Programming

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# Linear Programming Problem

# Formulating LP problem and writing constraints.

# *Objective function*

# Max: 420(X1+Y1+Z1)+360(X2+Y2+Z2)+300(X3+Y3+Z3);

# *Plant Production Constraint*

# X1+X2+X3 <= 750;

# Y1+Y2+Y3 <= 900;

# Z1+Z2+Z3 <= 450;

# *In-process Storage Constraint*

# 20X1+15X2+12X3 <= 13000;

# 20Y1+15Y2+12Y3 <= 12000;

# 20Z1+15Z2+12Z3 <= 5000;

# *Sales Constraint*

# X1+Y1+Z1 <= 900;

# X2+Y2+Z2 <= 1200;

# X3+Y3+Z3 <= 750;

# *Same Percentage Constraint*

# (1/750)*(X1+X2+X3)-(1/900)*(Y1+Y2+Y3)=0;

# (1/750)*(X1+X2+X3)-(1/450)*(Z1+Z2+Z3)=0;

# Installing and loading the lpsolve package

library(lpSolve)

# Coefficients of the objective function

objective\_c <- c(420, 360, 300, 420, 360, 300, 420, 360, 300)

# Setting the inequality constraint matrix

const\_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

const\_dir <- c("<=","<=","<=","<=","<=","<=","<=","<=","<=","=","=","=")

# Right hand side of constraints

const\_rhs <- c(900,1200,750,750,900,450,13000,12000,5000,0,0,0)

# Solving LP problem

Z = lp("max", objective\_c, const\_mat, const\_dir, const\_rhs)

# Printing variable values

cat("Optimal Solution (X1, X2, X3, Y1, Y2, Y3, Z1, Z2, Z3):\n", Z$solution, "\n")

## Optimal Solution (X1, X2, X3, Y1, Y2, Y3, Z1, Z2, Z3):  
## 516.6667 177.7778 0 0 666.6667 166.6667 0 0 416.6667

cat("Optimal Profit (P):\n", Z$objval, "\n")

## Optimal Profit (P):  
## 696000

# Optimal Profit = 696000

# Number of large, medium, and small sized products to be produced at plant 1

# X1 = 516.6667

# X2 = 177.7778

# X3 = 0

# Number of large, medium, and small sized products to be produced at plant 2

# Y1 = 0

# Y2 = 666.6667

# Y3 = 166.6667

# Number of large, medium, and small sized products to be produced at plant 3

# Z1 = 0

# Z2 = 0

# Z3 = 416.6667