Assignment: Solve LP Model Using R

Yash

2023-09-22

Problem: The Weigelt Corporation has three branch plants with excess production capacity. Fortunately, the corporation has a new product ready to begin production, and all three plants have this capability, so some of the excess capacity can be used in this way. This product can be made in three sizes–large, medium, and small–that yield a net unit profit of $420, $360, and $300, respectively. Plants 1, 2, and 3 have the excess capacity to produce 750, 900, and 450 units per day of this product, respectively, regardless of the size or combination of sizes involved. The amount of available in-process storage space also imposes a limitation on the production rates of the new product. Plants 1, 2, and 3 have 13,000, 12,000, and 5,000 square feet, respectively, of in-process storage space available for a day's production of this product. Each unit of the large, medium, and small sizes produced per day requires 20, 15, and 12 square feet, respectively. Sales forecasts indicate that if available, 900, 1,200, and 750 units of the large, medium, and small sizes, respectively, would be sold per day. At each plant, some employees will need to be laid off unless most of the plant's excess production capacity can be used to produce the new product. To avoid layoffs if possible, management has decided that the plants should use the same percentage of their excess capacity to produce the new product. Management wishes to know how much of each of the sizes should be produced by each of the plants to maximize profit.

Lets find the solution

```
library(lpSolveAPI)
x <- read.lp("Weigelt_Corporation.lp")
#Reading lp file in which we have described the problem with the proper contraints and objective functi
x
```

```
## Model name:
##   a linear program with 18 decision variables and 11 constraints
```

```
solve(x)
```

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

```
get.objective(x)        # get objective value
```

```
## [1] 708000
```

```
get.variables(x)        # get values of decision variables
```

```
##  [1] 350.0000   0.0000   0.0000 400.0000 400.0000 133.3333   0.0000 500.0000
##  [9] 250.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
## [17]   0.0000   0.0000
```

```
get.constraints(x)      # get constraint RHS values
```

```
##  [1]   750.0000   900.0000   383.3333 13000.0000 12000.0000  5000.0000
##  [7]   350.0000   933.3333   750.0000     0.0000     0.0000
```

Solution:

```
production_data <- data.frame(
  Plant = c("Plant 1", "Plant 2", "Plant 3"),
  Large = c(350, 0, 0),
  Medium = c(400, 400, 133.33),
  Small = c(0, 500, 250)
)

print(production_data)
```

```
##     Plant Large Medium Small
## 1 Plant 1   350 400.00     0
## 2 Plant 2     0 400.00   500
## 3 Plant 3     0 133.33   250
```

Management can maximize their profit to $708,000 by producing the products as follows:

Plant 1 should produce 350 units of Large, 400 units of Medium, and no Small products.

Plant 2 should produce no Large, 400 units of Medium, and 500 Small products.

Plant 3 should produce no Large, ~133 Medium, and 250 units of Small products.