A Report For LP Brewery

Saudi Digital Academy 2020 - Homework 3 week 6 - Oct 14, 2020

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Question: Build a report for LP Brewery telling them all the information from their new problem with Dantzig and their previous problem before Dantzig.

```
library(knitr)

df <- data.frame(Products     = c("Hopatronic", "American Kolsch style","Barrel-Aged Dantzig"),
                 varibale      = c("x_1", "x_2", "x_3"),
                 Price         = c("$ 13", "$ 23", "$ 30"),
                 Hour_of_Labor = c("5  hours", "10 hours", "20 hours"),
                 employees     = c(1, 1, 1),
                 Hops          = c(4, 4, 4),
                 Corn          = c(5, 15, 10),
                 Malt          = c(35, 20, 15)
                 )

kable(df)
```

Products	varibale	Price	Hour_of_Labor	employees	Hops	Corn	Malt
Hopatronic	x_1	$ 13	5 hours	1	4	5	35
American Kolsch style	x_2	$ 23	10 hours	1	4	15	20
Barrel-Aged Dantzig	x_3	$ 30	20 hours	1	4	10	15

First : Assuming
$$month = 29days = 696hours$$

Second : Objective Max
$$z = 13x_1 + 23x_2 + 30x_3$$

Third : Subject to:
$$5hx_1 + 10hx_2 + 20hx_3 <= 696$$

(Hours = 1 month)
$$x_1 + x_2 + x_3 <= 5$$

(Empolyees)
$$4x_1 + 4x_2 + 4x_3 <= 150$$

(Hops)
$$5x_1 + 15x_2 + 10x_3 <= 4800$$

(Corn)
$$35x_1 + 20x_2 + 15x_3 <= 1190$$

(Malt)
$$x_1, x_2, x_3 >= 0$$

Fourth : build a matrix fucntion for the the previous and the new problem with Dantzig:

```r
library(lpSolve)

#-----------------------------------------------------------
# The previous problem before Dantzig
#-----------------------------------------------------------
old_f.obj <- c(13,23)

old_f.col <- matrix(c(4,4,        # Hops
                      5,15,       # Corn
                      35,20),     # Malt
                    nrow =3,
                    byrow = T
                    )

old_f.dir <- c("<=",
               "<=",
               "<=")

old_f.rhs<-c(160,
             4800,
             1190)

old_sol<-lp("max",old_f.obj,old_f.col,old_f.dir,old_f.rhs,compute.sens = T)
old_sol$objval
```

```
## [1] 920
```

```r
old_sol$solution
```

```
## [1]   0 40
```

```r
# undrestading the dual help you undrestand the shadow prices
old_sol$duals
```

```
## [1]    5.75    0.00    0.00 -10.00    0.00
```

```r
#-----------------------------------------------------------
# The new  problem with Dantzig without hours and employees
#-----------------------------------------------------------
f.obj <- c(13,23,30)

f.col <- matrix(c(4, 4, 4,        # Hops
                  5,15,10,        # Corn
                  35,20,15),       # Malt
                nrow  = 3,
                byrow = T)

f.dir <- c("<=",
           "<=",
           "<=")

f.rhs<-c(160,
         4800,
         1190)
```

```r
# Fifth: solve the LP system
sol<-lp("max",f.obj,f.col,f.dir,f.rhs,compute.sens = T)
sol$objval
```

```
## [1] 1200
```

```r
sol$solution
```

```
## [1]   0   0 40
```

```r
# undrestading the dual help you undrestand the shadow prices
sol$duals
```

```
## [1]   7.5   0.0   0.0 -17.0  -7.0   0.0
```

```r
#-------------------------------------------------------------
# The new   problem with Dantzig
#-------------------------------------------------------------
f.obj <- c(13,23,30)

f.col <- matrix(c(5,10,20,      # Hours
                  1, 1, 1,      # Employee
                  4, 4, 4,      # Hops
                  5,15,10,      # Corn
                  35,20,15),    # Malt
              nrow  = 5,
              byrow = T)

f.dir <- c("<=",
           "<=",
           "<=",
           "<=",
           "<=")

f.rhs<-c(696,
         5   ,
         160,
         4800,
         1190)

# Fifth: solve the LP system
sol<-lp("max",f.obj,f.col,f.dir,f.rhs,compute.sens = T)
sol$objval
```

```
## [1] 150
```

```r
sol$solution
```

```
## [1] 0 0 5
```

```r
# undrestading the dual help you undrestand the shadow prices
sol$duals
```

```
## [1]   0  30   0   0   0 -17  -7   0
```