Assignment 2

SABIHA MHATARNAIK

10/2/2021

#Install lpSolveAPI package if not installed

```r
#install.packages("lpSolveAPI")
```

```r
#Now, load the library
library(lpSolveAPI)

#create an lp object named 'lprec' with 0 constraints and 9 decision variables
lprec <- make.lp(0,9)

#Now create the objective function. The default is a minimization problem.
set.objfn(lprec, c(420,420,420,
                   360,360,360,
                   300,300,300))

# As the default is a minimization problem, we change the direction to set maximization
lp.control(lprec,sense='max')
```

```
## $anti.degen
## [1] "fixedvars" "stalling"
##
## $basis.crash
## [1] "none"
##
## $bb.depthlimit
## [1] -50
##
## $bb.floorfirst
## [1] "automatic"
##
## $bb.rule
## [1] "pseudononint" "greedy"       "dynamic"      "rcostfixing"
##
## $break.at.first
## [1] FALSE
##
## $break.at.value
## [1] 1e+30
##
## $epsilon
##       epsb       epsd      epsel     epsint epsperturb   epspivot
```

```
##      1e-10      1e-09      1e-12      1e-07      1e-05      2e-07
##
## $improve
## [1] "dualfeas" "thetagap"
##
## $infinite
## [1] 1e+30
##
## $maxpivot
## [1] 250
##
## $mip.gap
## absolute relative
##    1e-11    1e-11
##
## $negrange
## [1] -1e+06
##
## $obj.in.basis
## [1] TRUE
##
## $pivoting
## [1] "devex"    "adaptive"
##
## $presolve
## [1] "none"
##
## $scalelimit
## [1] 5
##
## $scaling
## [1] "geometric"   "equilibrate" "integers"
##
## $sense
## [1] "maximize"
##
## $simplextype
## [1] "dual"   "primal"
##
## $timeout
## [1] 0
##
## $verbose
## [1] "neutral"
```

```r
#Add the 12 constraints based on the plant's number and products made on those plants.
add.constraint(lprec ,c(1,0,0,1,0,0,1,0,0), "<=", 750)
add.constraint(lprec ,c(0,1,0,0,1,0,0,1,0), "<=", 900)
add.constraint(lprec ,c(0,0,1,0,0,1,0,0,1), "<=", 450)

add.constraint(lprec ,c(20,0,0,15,0,0,12,0,0), "<=", 13000)
add.constraint(lprec ,c(0,20,0,0,15,0,0,12,0), "<=", 12000)
add.constraint(lprec ,c(0,0,20,0,0,15,0,0,12), "<=", 5000)
```

```
add.constraint(lprec ,c(1,1,1,0,0,0,0,0,0), "<=", 900)
add.constraint(lprec ,c(0,0,0,1,1,1,0,0,0), "<=", 1200)
add.constraint(lprec ,c(0,0,0,0,0,0,1,1,1), "<=", 750)

add.constraint(lprec ,c(900,-750,0,900,-750,0,900,-750,0), "=", 0)
add.constraint(lprec ,c(0,450,-900,0,450,-900,0,450,-900), "=", 0)
add.constraint(lprec,c(450,0,-750,450,0,-750,450,0,-750),"=",0)
```

Set bounds for variables.

Remember that all variables had to be non-negative. We don't need to do it here,as this is the default , we can set bounds explicitly.

```
#Set bounds for variables.
set.bounds(lprec ,lower =c(0,0,0,0,0,0,0,0,0),
           columns= c (1:9))  #Not really needed

# To identify  the variables and constraints, we can set variable names and constraint names.
RowNames <-c("P1ProductionCapacity","P2ProductionCapacity","P3ProductionCapacity",
             "P1StorageSpace","P2StorageSpace","P3StorageSpace",
             "SalesForecastLarge","SalesForecastMedium","SalesForecastSmall",
             "PercentCapacityP1andP2","PercentCapacityP2andP3","PercentCapacityP1andP3")

ColNames <- c("Plant1Large","Plant2Large","Plant3Large",
              "Plant1Medium","Plant2Medium","Plant3Medium",
              "Plant1Small","Plant2Small","Plant3Small")

dimnames(lprec)<- list (RowNames,ColNames)

#Now view the Model
lprec
```

```
## Model name:
##   a linear program with 9 decision variables and 12 constraints
```

```
# The model can also be saved to a file
write.lp(lprec, filename = "weigelt.lp", type = "lp")
```

Now we can solve the above LP Problem

```
solve(lprec)
```

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

The output above indicated that the answer is 0, means there was a successful solution. We now output the value of the objective function, and the variables.

```
get.objective(lprec)
```

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

```
get.variables(lprec)
```

```
## [1] 516.6667   0.0000   0.0000 177.7778 666.6667   0.0000   0.0000 166.6667
## [9] 416.6667
```

From the above solution, we can infer the following : Plant 1 : 516.67 of Large Products and 177.78 of Medium Products. Plant 2 : 666.67 of Medium Products and 166.67 of Small products. Plant 3 : 416.67 of Small Products

```
get.constraints(lprec)
```

```
##  [1]   694.4444   833.3333   416.6667 13000.0000 12000.0000  5000.0000
##  [7]   516.6667   844.4444   583.3333     0.0000     0.0000     0.0000
```

We now read the lp formulation using an lp file. I am using the same R file which I have saved.

```
a <- read.lp ("weigelt.lp")  # create an lp object a
a                            #display a
```

```
## Model name:
##   a linear program with 9 decision variables and 12 constraints
```

Solve the lp model

```
solve(a)                     #get objective value
```

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

```
get.objective(a)             #get values of decision variables
```

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

```
get.constraints(a)           #get constraint values
```

```
##  [1]   694.4444   833.3333   416.6667 13000.0000 12000.0000  5000.0000
##  [7]   516.6667   844.4444   583.3333     0.0000     0.0000     0.0000
```