

Assignment 6

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1

```
library(lpSolveAPI)
lpec1<-make.lp(0,12)
set.objfn(lpec1,c(5,3,2,3,4,4,1,6,2,7,4,5))
lp.control(lpec1,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"

add.constraint(lpec1,c(1,1,0,0,0,0,0,0,0,0,0,0), "=", 1)
add.constraint(lpec1,c(1,0,-1,0,-1,0,0,0,0,0,0,0), "=", 0)
add.constraint(lpec1,c(0,1,0,-1,0,0,0,0,0,0,0,0), "=", 0)
add.constraint(lpec1,c(0,0,0,0,1,-1,-1,0,0,0,0,0), "=", 0)
add.constraint(lpec1,c(0,0,1,1,0,0,0,-1,-1,0,0,0), "=", 0)
add.constraint(lpec1,c(0,0,0,0,0,0,1,0,0,0,0,-1), "=", 0)
add.constraint(lpec1,c(0,0,0,0,0,1,0,1,0,0,-1,0), "=", 0)
add.constraint(lpec1,c(0,0,0,0,0,0,0,0,0,1,-1,0,0), "=", 0)
add.constraint(lpec1,c(0,0,0,0,0,0,0,0,0,0,1,1,1), "=", 1)
Colnames<-c("X12", "X13", "X25", "X35", "X24", "X47", "X46", "X57", "X58", "X89",
"X79", "X69")
Rownames<-c("U1", "U2", "U3", "U4", "U5", "U6", "U7", "U8", "U9")
dimnames(lpec1)<-list(Rownames, Colnames)
write.lp(lpec1, filename = "Assignment6.lp", type = "lp")
solve(lpec1)

## [1] 0

```

```

get.objective(lpec1)

## [1] 17

cbind(Colnames,get.variables(lpec1))

##      Colnames
## [1,] "X12"    "1"
## [2,] "X13"    "0"
## [3,] "X25"    "0"
## [4,] "X35"    "0"
## [5,] "X24"    "1"
## [6,] "X47"    "1"
## [7,] "X46"    "0"
## [8,] "X57"    "0"
## [9,] "X58"    "0"
## [10,] "X89"   "0"
## [11,] "X79"   "1"
## [12,] "X69"   "0"

```

Running the LP formulation on any LP solver, the critical path is:

From node 1 to 2

From node 2 to 4

From node 4 to 7

From node 7 to 9

The duration of project is 17 times.

2

```

lpec2<-make.lp(0,8)
set.objfn(lpec2,c(4,6.5,5.9,5.4,5.15,10,8.4,6.25))
lp.control(lpec2,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"

add.constraint(lpec2,c(40,50,80,0,0,0,0,0),"<=",1000)
add.constraint(lpec2,c(0,0,0,60,45,60,0,0),"<=",1000)
add.constraint(lpec2,c(0,0,0,0,0,0,30,25),"<=",1000)
add.constraint(lpec2,c(40,0,0,0,0,0,0,0),">=",100)
add.constraint(lpec2,c(0,50,0,0,0,0,0,0),">=",100)
add.constraint(lpec2,c(0,0,80,0,0,0,0,0),">=",100)
add.constraint(lpec2,c(0,0,0,60,0,0,0,0),">=",100)
add.constraint(lpec2,c(0,0,0,0,45,0,0,0),">=",100)
add.constraint(lpec2,c(0,0,0,0,0,60,0,0),">=",100)
add.constraint(lpec2,c(0,0,0,0,0,0,30,0),">=",100)
add.constraint(lpec2,c(0,0,0,0,0,0,0,25),">=",100)
add.constraint(lpec2,c(40,50,80,60,40,60,30,25),"<=",2500)
set.type(lpec2,1:8,"integer")
Colnames<-c("S1","S2","S3","H1","H2","H3","C1","C2")
Rownames<-c("U1","U2","U3","U4","U5","U6","U7","U8","U9","U10","U11","U12")
dimnames(lpec2)<-list(Rownames,Colnames)

write.lp(lpec2,filename = "Assignment6(2).lp",type = "lp")

solve(lpec2)

## [1] 0

get.objective(lpec2)

## [1] 479.55

get.variables(lpec2)

## [1] 3 5 2 2 3 12 30 4

cbind(Colnames,get.variables(lpec2))

##      Colnames
## [1,] "S1"      "3"
## [2,] "S2"      "5"
## [3,] "S3"      "2"
## [4,] "H1"      "2"
## [5,] "H2"      "3"
## [6,] "H3"     "12"
## [7,] "C1"     "30"
## [8,] "C2"      "4"

```

The ammount of stock shares(in thousand):

"S1" 3 "S2" 5 "S3" 2 "H1" 2 "H2" 3 "H3" 12 "C1" 30 "C2" 4

The max return is \$479,550.

The amount of dollar invested in each stock(in thousand):

"S1" 120 "S2" 250 "S3" 160 "H1" 120 "H2" 135 "H3" 720 "C1" 900 "C2" 100

```
# no integer restriction
lpec3<-make.lp(0,8)
set.objfn(lpec3,c(4,6.5,5.9,5.4,5.15,10,8.4,6.25))
lp.control(lpec3,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"

add.constraint(lpec3,c(40,50,80,0,0,0,0,0), "<=", 1000000)
add.constraint(lpec3,c(0,0,0,60,45,60,0,0), "<=", 1000000)
add.constraint(lpec3,c(0,0,0,0,0,0,30,25), "<=", 1000000)
add.constraint(lpec3,c(40,0,0,0,0,0,0,0), ">=", 100000)
add.constraint(lpec3,c(0,50,0,0,0,0,0,0), ">=", 100000)
add.constraint(lpec3,c(0,0,80,0,0,0,0,0), ">=", 100000)
add.constraint(lpec3,c(0,0,0,60,0,0,0,0), ">=", 100000)
add.constraint(lpec3,c(0,0,0,0,45,0,0,0), ">=", 100000)
add.constraint(lpec3,c(0,0,0,0,0,60,0,0), ">=", 100000)
add.constraint(lpec3,c(0,0,0,0,0,0,30,0), ">=", 100000)
add.constraint(lpec3,c(0,0,0,0,0,0,0,25), ">=", 100000)
add.constraint(lpec3,c(40,50,80,60,40,60,30,25), "<=", 2500000)
set.type(lpec3,1:8, "integer")
Colnames<-c("S1", "S2", "S3", "H1", "H2", "H3", "C1", "C2")
Rownames<-c("U1", "U2", "U3", "U4", "U5", "U6", "U7", "U8", "U9", "U10", "U11", "U12")
dimnames(lpec3)<-list(Rownames,Colnames)

solve(lpec3)

## [1] 0

get.objective(lpec3)

```

```
## [1] 488592.2
get.variables(lpec3)
## [1] 2501 6222 1250 1667 2223 13332 30000 4000
(log(get.objective(lpec3))-log(get.objective(lpec2)*1000))*100
## [1] 1.868013
```

The integer restricts nearly 1.87% about the value of return.

```
abc<-cbind.data.frame(Colnames,get.variables(lpec2)*1000,get.variables
(lpec3))
abc$pre<-round((log(abc$`get.variables(lpec3)`)-log(abc$`get.variables
(lpec2) * 1000`))*100,2)
cbind(abc$Colnames,abc$pre)

##      [,1] [,2]
## [1,] "S1" "-18.19"
## [2,] "S2" "21.87"
## [3,] "S3" "-47"
## [4,] "H1" "-18.21"
## [5,] "H2" "-29.98"
## [6,] "H3" "10.53"
## [7,] "C1" "0"
## [8,] "C2" "0"
```

The percentage of investment quantities change is(%): "S1" "-18.19" "S2" "21.87"
 "S3" "-47"
 "H1" "-18.21" "H2" "-29.98" "H3" "10.53" "C1" "0"
 "C2" "0"