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(0,0,0,0,0,0,0,0,1,-1,0,0),"=",0)  
add.constraint(lpec1,c(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 ammout 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 dolloar 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”