# Homework 6

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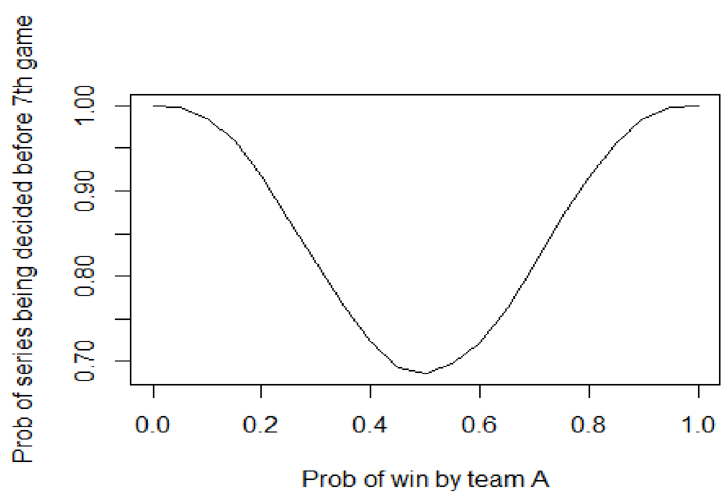
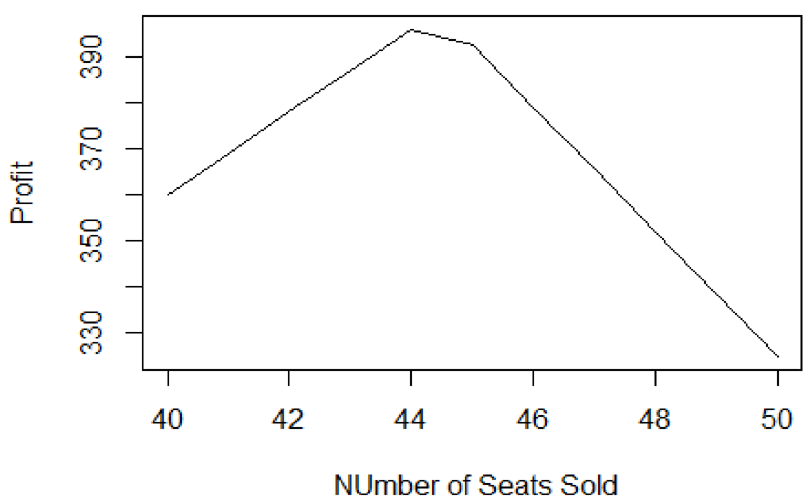
## Question 1

```
Pwin = seq(0, 1, 0.05)

# To find probability that series will be decided before 7th game;
# let that probability be Pwin7
# Initialize Pwin7

Pwin7 = c()
for (i in Pwin) {
  sim = rbinom(100000,6,i)
  Pwin7 = c(Pwin7, mean(sim >= 4 | sim <= 2))
}
Pwin7

##  [1] 1.00000 0.99801 0.98547 0.95901 0.91793 0.86615 0.81477 0.76479
##  [9] 0.72277 0.69311 0.68607 0.69779 0.72246 0.76304 0.81464 0.86835
## [17] 0.91700 0.95721 0.98541 0.99797 1.00000

# Plotting probabilities for various p values

plot(Pwin, Pwin7, type="l", xlab="Prob of win by team A", ylab="Prob of
series being decided before 7th game")
```



## Question 2

```r
# The minimum seats booked would be 40; let's take 40-50 as the range with increments of 1
n = seq(40, 50, 1)
p = c()
for (i in n) {
  nShow = mean(rbinom(100000,i,0.9))
  Revenue = nShow * 10
  nExcess = nShow - 40
  if (nExcess > 0) {
    Cost = nExcess * 25
    Profit = Revenue - Cost
  }
  else {
    Profit = Revenue  #Cost is zero here
  }
  p = c(p,Profit)
}

#Plotting the Number os sold seats vs the Profit for each

plot(n, p, type="l", xlab=" NUmber of Seats Sold", ylab="Profit")
```




```r
max(p)

## [1] 395.9771
```

```
# At what number of seats is the Profit maximum
n[which.max(p)]

## [1] 44
```

Therefore, 44 tickets must be sold!

## Question 3

```
library(triangle)

library(lpSolveAPI)

time = c()
num_k = 0
num_l = 0

for (i in (1:10000)) {
  l = matrix(0,16,16)
  l[1,2] = rltriangle(a=8, b=16, c=9) #A
  l[2,3] = l[2,4] = rltriangle(a=4, b=12, c=5) #B
  l[3,5] = l[3,7] = rltriangle(a=5, b=7, c=6) #C
  l[4,6] = l[4,7] = rltriangle(a=4, b=16, c=13) #D
  l[5,6] = rltriangle(a=3, b=5, c=4) #E
  l[6,8] = l[6,9] = rltriangle(a=2, b=4, c=3) #F
  l[7,10] = rltriangle(a=4, b=8, c=6) #G
  l[8,12] = rltriangle(a=10, b=18, c=11) #H
  l[9,11] = rltriangle(a=3, b=3, c=3) #I
  l[10,13] = rltriangle(a=12, b=16, c=14) #J
  l[11,12] = rltriangle(a=3, b=5, c=4) #K
  l[12,14] = l[12,13] = rltriangle(a=2, b=4, c=3) #L
  l[13,15] = rltriangle(a=8, b=8, c=8) #M
  l[14,15] = rltriangle(a=6, b=22, c=11) #N
  l[15,16] = rltriangle(a=3, b=6, c=4) #O

  lanProj <- make.lp(0,16*16)

  #set objective coefficients
  set.objfn(lanProj, as.vector(t(l)))

  #set objective direction
  lp.control(lanProj,sense='max')

  nodes = c(1:16)

  rhs = c(1,rep(0,14),-1)
  for (n in 1:16){
    coef = c(l[n,1:16]/l[n,1:16],-l[1:16,n]/l[1:16,n])
    ind = c((n-1)*16+c(1:16),(c(1:16)-1)*16+n)
```

```r
    nz = is.finite(coef)
    add.constraint(lanProj,coef[nz], "=",rhs[n],ind[nz])
  }

  ColNames = c()
  RowNames = c()
  for(i in 1:16){
    for(j in 1:16){
      ColNames = cbind(ColNames,paste("x",i,",",j, sep=""))
    }
    RowNames=cbind(RowNames,paste("node",i))
  }

  dimnames(lanProj) <- list(RowNames, ColNames)
  set.type(lanProj, c(1:256), "binary")

  #write to text file
  write.lp(lanProj,'lanProj.lp',type='lp')


  #solve the model, if this return 0 an optimal solution is found
  status = solve(lanProj)

  #this return the proposed solution
  time = c(time, get.objective(lanProj))
  x = get.variables(lanProj)
  if (sum(matrix(x,16,16)[,11]) > 0) {
    num_k = num_k + 1
  }
  if (sum(matrix(x,16,16)[,12]) > 0) {
    num_l = num_l + 1
  }
}

mean(time)

## [1] 62.81269
```

We ran 10,000 simulations; the expected (mean) completion time is 62.9 secs.

```r
num_k/10000

## [1] 0
```

K falls on the longest path 0% of the time

```r
num_l/10000
```

```
## [1] 0.8117
```

L falls on the longest path 81.17% of the time.

## Question 4

```
car=c()
pick=c()

# Using sw for switch option
Sw =c()
SwitchWin = 0
StickWin = 0
t<-proc.time()
for (s in 1:10000){
  # 33 doors
  car[s]=sample(33,1)
  pick[s]=sample(33,1)

  x=setdiff(c(1:33),union(pick[s],car[s]))
  host=x[sample(length(x),5)]

  StickWin = StickWin + (car[s] == pick[s])

  Sw[s]=sample(setdiff(c(1:33),union(pick[s],host)),1)
  SwitchWin = SwitchWin + (car[s] == Sw[s])
}

SwitchWin/10000

## [1] 0.0341
```

This is the probabilty of winning if Switch is made

```
StickWin/10000

## [1] 0.0299
```

This is the probability of winning if switch is not made

## Question 5

Here we need the ten probablity values

```
max = rep(0,10)

for (i in (1:10000)) {
```

```
  Rem = 100  # A portion of this remaining amount will be allotted to next 
person and   so on
  All = c()  #Initiallizing the allocations

  p <- c(runif(9),1)
  for (j in p) {
    newAll = Rem * j
    All = c(All, newAll)
    Rem = Rem - newAll
  }
  max[which.max(All)] = max[which.max(All)] + 1
}

max/10000

##  [1] 0.6264 0.2443 0.0916 0.0278 0.0073 0.0018 0.0005 0.0002 0.0000 0.0001
```

The ten probabilities are thus shown above