Analytic 511 Homework 4

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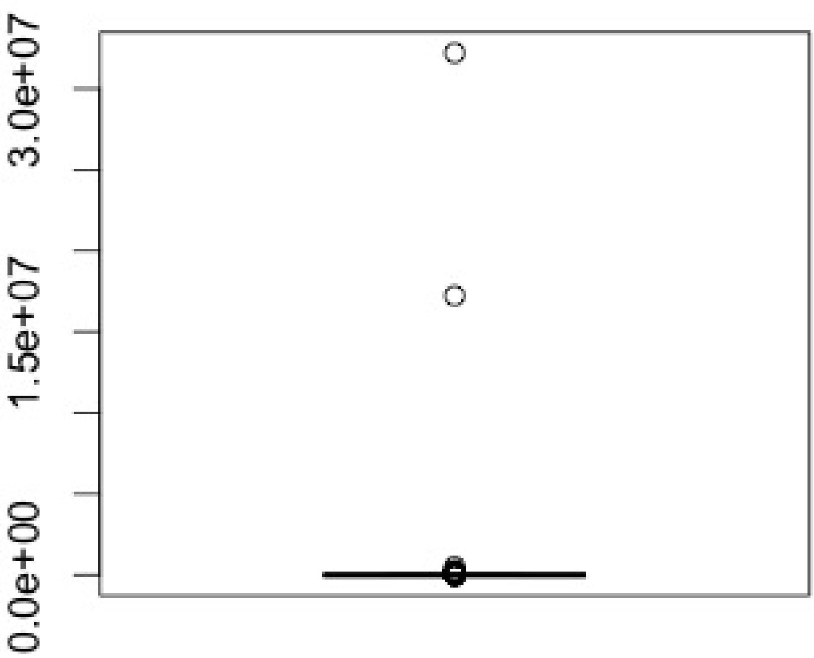
Excerise 25




```
summary(Problem25)
#Min.   1st Qu.    Median      Mean   3rd Qu.       Max.
#44        294       701    209800      3151  32220000
```

Excerise 26

The Proposed modification is to bet 6 times after losing a bet twice; otherwise, successive bets in the event of a previous winning bet should follow the same logic as the original St. Petersburg system. The logic

$P(LLL) = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

$P(W|LL) = \frac{P(WLL)}{P(LL)} = \frac{\left(\frac{2}{3}\right)^2 * \frac{1}{3}}{\left(\frac{2}{3}\right)^2} = \frac{1}{3}$

$E(LLW) = -1 * \frac{2}{3} - 1 * \frac{2}{3} + 6 * \frac{1}{3} = 2$

Basically the idea is that the chances of a losing steak dimishes over the long run; thus, at the point of losing steak, betting more may cause the Expected gain to level out as the probabily of a continued L over L dimishes over time. The idea being while $P(L|LL) = \frac{2}{3}$, the event that n loses in a row occurs will significantly lessen. The up side being, if the guy has a bad losing streak, the game ends faster.

Excerise 27

$P(RE) = \frac{8}{38}$

$P(BO) = \frac{8}{38}$

$P(RO) = \frac{10}{38}$

$P(BE\&0\&00) = \frac{12}{38}$

$E(X) = \frac{8}{38} * 0 + \frac{8}{38} * 0 + \frac{10}{38} * 2 - \frac{12}{38} * -2 = -\frac{4}{38}$

Excerise 28

False, at the edges and corners the weight of the probabilities with change since we are given that the frog may not hop onto a wall.

Excerise 29

$P(X = x, Y = y) = P(Y = y|X = x) * P(X = x) = \left(\begin{pmatrix} x \\ y \end{pmatrix} p^y (1-p)^{x-y}\right) * \frac{1}{n}$

Excerise 30

Part A

$P(X = 6|X = 6) = 0.5$

$P(X = 3|X = 6) = 0.25$

$P(X = 5|X = 6) = 0.25$

Part B

see code for part B of Exercise 30

Part C

$P(survival) = 0.780697$

Excerise 31

Part A

$P(N = n, X = x) = P(X = x|N = n) * P(N = n) = \left(\begin{pmatrix} n \\ x \end{pmatrix} p^x * (1-p)^{n-x}\right) * \frac{\lambda^n e^{-\lambda}}{n!}$

Part B

see code for part B of Exercise 30

Part C

$E(N = n) = \lambda$

$E(X = x|N = n) = \lambda * p$

In the simulation, one of the combinations I set was $\lambda = 15$ and $p = 0.3$

$\therefore E(X = x|N = n) = 15 * 0.3 = 4.5$

On average, my simulation was off from the the actual value by 0.002683333.

Excerise 32

Part A

$c = 0.0006578947$

for parts B and C please the comments in the code.

```
#####Problem 25
randomWalk = function(){
x = 0
t = 0
while(x <20){
  if(as.logical(rbinom(1,1,.5))){
    x = x+1
    t = t+1
  }
  else{
    x = x-1
    t = t+1
  }
}
return(t)
}
Problem25 = replicate(250, randomWalk())
summary(Problem25)
#Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
#44      294      701   209800     3151 32220000
#####Problem 30
###Part B
Problem30 = matrix(data = 0, nrow= 9, ncol = 9)
Problem30[1, c(1,2,4)] = c(.5,.25,.25)
Problem30[2, c(1,2,3,5)] = c(.5/3,.5,.5/3, .5/3)
Problem30[3, c(2,3,6)] = c(.5/2,.5,.5/2)
Problem30[4, c(1,4,5,7)] = c(.5/3,.5,.5/3, .5/3)
Problem30[5, c(4,5,2,6)]= c(.5/3,.5,.5/3, .5/3)
Problem30[6, c(5,6,3)] = c(.25,.5,.25)
Problem30[7, c(4,7,8)] = c(.25,.5,.25)
Problem30[8, c(7,8,9)] = c(.25,.5,.25)
Problem30[9, 9] = 1


Problem30b = Problem30%*%Problem30
###Part C
Problem30c = Problem30b
for(i in 1:28){
  Problem30c = Problem30c%*%Problem30
}
1 - Problem30c[1,9]
#[1] 0.780697
#####Problem 31
###Part B
pmfBE = function(lambda, p, k){
  return(replicate(k, rbinom(1, rpois(1, lambda), p)))
}
###Part C
Problem31C = c()
for(p in c(1:3/10)){
```

```
  for(lambda in c(12:15)){
    Problem31C = c(Problem31C,lambda*p - mean(
      replicate(1000, mean(pmfBE(lambda, p, 10)))))
  }
}
#[1] 4.50175
###Actual Mean

#[1] 4.5
#####Problem 32
###Part A
Problem32A = matrix(nrow = 8, ncol = 10)
for(x in 1:10){
  for(y in 1:8){
    Problem32A[y,x] = x+3*y
  }
}
c = 1/sum((Problem32A))
Problem32A = c*Problem32A
c
#[1] 0.0006578947
###Part B
X = colSums(Problem32A)
X
#[1] 0.07631579 0.08157895 0.08684211 0.09210526 0.09736842 0.10263158
0.10789474
#[8] 0.11315789 0.11842105 0.12368421
Y = rowSums(Problem32A)
Y
#[1] 0.05592105 0.07565789 0.09539474 0.11513158 0.13486842 0.15460526
0.17434211
#[8] 0.19407895
###Part C
Z = Problem32A[, 5]
Z
#[1] 0.005263158 0.007236842 0.009210526 0.011184211 0.013157895
0.015131579
#[7] 0.017105263 0.019078947
```