Lab5 Assignment

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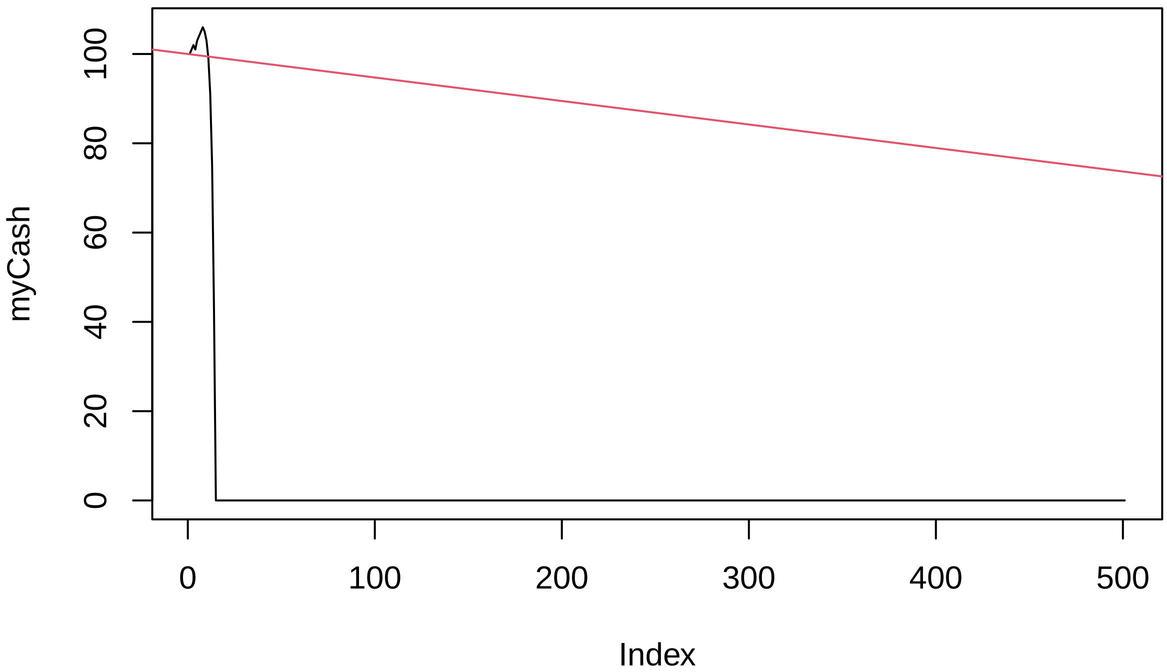
Problem 1

St. Petersburg System

- Starting bet $1, always on RED. Double after each loss if possible.
- Play until the money is gone.
- Repeat this a number of times.

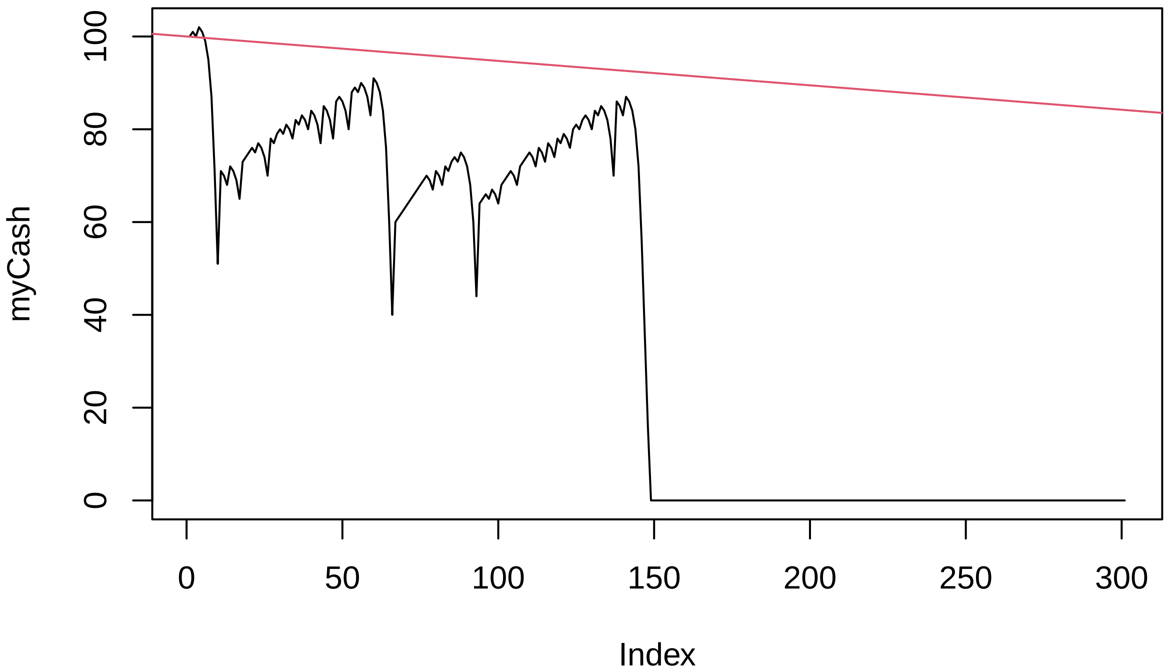
(i) *Discuss this with your class mates and explain what is happening here in few sentences. For example, redo this for different initial amounts such as $100, $500, $1000. What can you interpret?*

```
p = 18/38   # probability of winning
X0 = 100    # initial amount
N = 500    # maximal number of spins

myCash = c(X0, rep(0,N)) # vector for my cash

spins <- rbinom(N,1,p) # simulate  N  spins

counter  = 1  # keep track of number of games

lastspin = 1  # initialize memory of last games

myBet = 1

while(myCash[counter] > 0 & counter <= N){#this goes on until I loose all my money or reaches the maxim
  myBet <- min(c(2*myBet,myCash[counter]))
  if(lastspin == 1){myBet <- 1}
  myCash[counter + 1] <- myCash[counter] + (2*spins[counter] - 1)*myBet
  lastspin <- spins[counter]
  counter <- counter + 1
}
plot(myCash, type = 'l')             # plot of my cash
abline(a = X0, b = -1/19, col = 2)  # plot expected trend
```



(ii) *Discuss this with your class mates and explain what is happening here in few sentences. For example, redo this for two different maximal bets and 2 different maximal number of spins. What can you interpret?*

```
p = 18/38    # probability of winning
maxBet = 20      # maximal bet
X0 = 100     # initial amount
N = 300     # maximal number of spins
myCash = c(X0, rep(0,N)) # vector for my cash

spins <- rbinom(N,1,p) # simulate  N  spins
counter  = 1  # keep track of number of games
lastspin = 1  # initialize memory of last games
myBet = 1
while(myCash[counter] > 0 & counter <= N){
  myBet <- min(c(2*myBet,myCash[counter], maxBet))
  if(lastspin == 1){myBet <- 1}
  myCash[counter + 1] <- myCash[counter] + (2*spins[counter] - 1)*myBet
  lastspin <- spins[counter]
  counter <- counter + 1
}
plot(myCash, type = 'l')             # plot of my cash
abline(a = X0, b = -1/19, col = 2)  # plot expected trend
```



Problem 2

Consider the random walk performed by the caveman in the class slides.

a) Using the transition matrix that was derived in class, compute $P(X_3 = 3|X_0 = 1)$. Then do the same computation directly.

What does this probability means?

b) Find the first time T such that the chance of the caveman's survival for more than T steps is less than 25 % no matter where he starts, using **R**.

i.e find T such that $P(X_T = 9|X0 = k) \geq .75$ for all k and $P(X_{T-1}|X_0=j) <0.25 $ for at least one j.

(Hint:Assuming the caveman starts in position $j < 9$ and goes k steps, he will be dead with probability $p = P^k_{j9}$. Thus he will survive with probability < 0.25 no matter where he starts if $P^k_{j9} > .75$ for all j.)