Martingale Strategy

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## 1

set.seed(123)  
martingale = function(){  
 # Variables  
 #how many times you bet  
 bet\_count = 0  
   
 #bet amount ($1)  
 bet\_amount = 1  
   
 #win/lose record of each bet on red (using 1/0)  
 win = 0  
 lose = 0  
 record = c()  
   
 #money in pocket after each bet (running total)  
 running\_total = 100  
   
 # Colors  
 red = c(1,3,5,7,9,12,14,16,18,19,21,23,25,27,30,32,34,36)  
 black = c(2,4,6,8,10,11,13,15,17,20,22,24,26,28,29,31,33,35)  
 green = c(0)  
   
 # Lists  
 bet\_amount\_list = c()  
 record\_list = c()  
 running\_total\_list = c()  
 game\_outcome = 0  
   
   
 #While loop: won $10 or more OR you dont have enough money to make next bet  
 while ((running\_total - 100 < 10) && (bet\_amount < running\_total)){  
   
 outcome = sample(0:36, 1)  
   
 #if: number lands on red (18/37)  
 if (is.element(outcome, red) == TRUE){  
 running\_total = running\_total + bet\_amount  
 running\_total\_list <- c(running\_total\_list, running\_total)  
 bet\_count = bet\_count + 1  
 win <- win + 1  
 record = c("(",win, "-" , lose, ")")  
 record\_list <- c(record\_list, record)  
 bet\_amount = 1  
 bet\_amount\_list <- c(bet\_amount\_list, bet\_amount)  
 }  
   
 #if: number lands on black (18/37)  
 if (is.element(outcome, black) == TRUE){  
 running\_total = running\_total - bet\_amount  
 running\_total\_list <- c(running\_total\_list, running\_total)  
 bet\_count = bet\_count + 1  
 lose = lose + 1  
 record = c("(",win, "-" , lose, ")")  
 record\_list <- c(record\_list, record)  
 bet\_amount = bet\_amount \* 2  
 bet\_amount\_list <- c(bet\_amount\_list, bet\_amount)  
 }  
   
 #if: number lands on green (1/37)  
 if (is.element(outcome, green) == TRUE){  
 running\_total = running\_total - bet\_amount  
 running\_total\_list <- c(running\_total\_list, running\_total)  
 bet\_count = bet\_count + 1  
 lose = lose + 1  
 record = c("(",win, "-" , lose, ")")  
 record\_list <- c(record\_list, record)  
 bet\_amount = bet\_amount \* 2  
 bet\_amount\_list <- c(bet\_amount\_list, bet\_amount)  
 }  
 }  
   
   
 #final win/lose result  
 record\_final = c("(",win, "-" , lose, ")")  
   
   
 #final balance (start with $100)  
 final\_balance = running\_total  
   
   
 #win?  
 if(final\_balance>=110){  
 game\_outcome=1 #1 for win  
 }  
   
 #create output  
 output = list("How many times you bet" = bet\_count,  
 "Amount of each bet" = bet\_amount\_list,   
 "Win/lose record of each bet" = record\_list,   
 "Money in pocket after each bet" = running\_total\_list,   
 "Wins" = win, "Losses" = lose, "Final balance" = final\_balance,  
 "Game Outcome" = game\_outcome)  
  
 output  
 #return(win)  
}

## 2

set.seed(123)  
   
win\_sum = c()  
win\_count = c()  
play\_time = c()  
final\_bal = c()  
n = 100000  
  
for (i in 1:n){  
 sim = martingale()  
 win\_sum[i] <- sim[5]#number of bets won per game// 1  
 win\_count[i]<- sim[8]#number of wins and losses //2  
 play\_time[i] <- sim[1]#number of bets won in sim// 3  
 final\_bal[i] <-sim[7]#final balance for each game//4  
}  
  
#Numerical approximation for 1.  
mu <- mean(as.numeric(win\_sum))#average number of bets won per game  
mu

## [1] 9.04637

#95% confidence interval for 1.  
vari = var(as.numeric(win\_sum))  
c(mu - 1.96 \* sqrt(vari/n), mu + 1.96 \* sqrt(vari/n))

## [1] 9.031364 9.061376

#Proportions of games for 2.  
avg\_wins = mean(as.numeric(win\_count))  
avg\_wins

## [1] 0.83106

var\_wins = var(as.numeric(win\_count))  
  
#confidence interval for 2.  
c(avg\_wins - 1.96 \* sqrt(var\_wins/n), avg\_wins + 1.96 \* sqrt(var\_wins/n))

## [1] 0.8287376 0.8333824

#Expected Playing Time for 3.  
avg\_bets=mean(as.numeric(play\_time))#average number of total bets in sim  
avg\_bets

## [1] 18.57844

var\_bets=var(as.numeric(play\_time))#variance of total bets in sim  
  
#95% confidence interval for 3.  
c(avg\_bets - 1.96 \* sqrt(var\_bets/n), avg\_bets + 1.96 \* sqrt(var\_bets/n))

## [1] 18.54925 18.60763

#Max amount can lose for 4.  
100 - min(as.numeric(final\_bal)) #maximum amount of money lost

## [1] 63

## 3

bet\_index <- c()  
balances <- c(1000)  
finals<- c()  
  
for (i in 1:1000){  
 sim = martingale()  
 bet\_index[i] <- sim[1]  
 balances[i] <- sim[4]  
 finals[i] <- sim[7]  
}  
  
plot(1:as.numeric(bet\_index[1]), unlist(balances[1]), type = 'l',xlim = c(1,max(as.numeric(bet\_index))),ylim = c(min(unlist(balances)),max(unlist(balances))))  
  
for (i in 2:1000){  
 lines(unlist(balances[i]),col=ifelse(finals[i]==110,'blue','red'))  
}

