Shiny App application with Real Gambling Problem

Tianshu Zhao

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Introduction

After we studied Shiny App, I found that “Shiny” is a extremely useful package.It provides a vivid and active visualization for user to monitor the output changes when they modify the data inputs. Personally, I am a big fun of Casino, so I decide to make a gambling model for my winning probability. This post aims to explain one simple question relative to statistics: *“If the odds of losing a bet are 50%(according to the rules from Casino), why would long-run gambling makes people lose all the money instead of getting the balance of payment?”* Applying the analytical approach in statistics , I make a simple shiny app gamling model to explain the problem.

Background

Assume that we pay for the amount of X in each bet, the probability distribition is:

$$Xt = +1, p$$

$$Xt = -1, 1-p$$

and 0 <= p <= 1,and all the bets are independent. We assume the gambler’s wealth value is W(t) before he loses all the money(or receives the gambling money)

$$Wt = w + X1 + X2 + X3 + ... + Xt$$

And the marginal condition for losing all the money is:

$$Wr = -C$$

, the marginal condition for player to stop playing is

$$Wr = w + A$$

. So the probability of getting $A in the end is:

$$P(Wr = w + A \mid Wo = W) = (1/p-1)^{(}W + C) - 1/(1/p-1)^{(}w + C + A ? ? - 1$$

So, when p is colse to 50%, the probability is close to balance.

And we assue the number of times we expect to play before we leave the table:

$$r \mid Wo = w] = (w + C)/(1-2p) - (w + C + A)/(1-2p) * (1 - (1/p-1)^{(}w + C))/(1 - (1/p-1)^{(}w + C + A)$$

Code for gambling model

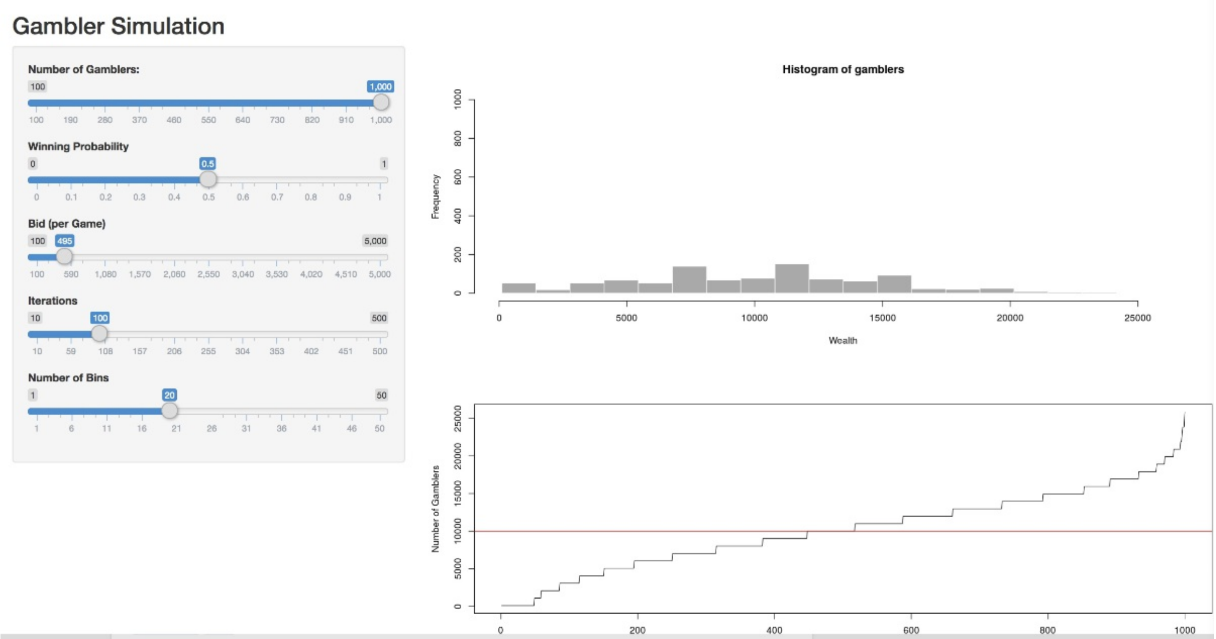
```r
library(shiny)
# Define UI for application that draws a histogram
ui <- shinyUI(fluidPage(

   # Application title
   titlePanel("Gambler Simulation"),

   # Sidebar with a slider input for number of bins
   sidebarLayout(
      sidebarPanel(
         sliderInput("size",
                     "Number of Gamblers:",
                     min = 100,
                     max = 1000,
                     value = 20),
         sliderInput("winp",
                     "Winning Probability",
                     min = 0,
                     max = 1,
                     value = 20),
         sliderInput("bid",
                     "Bid (per Game)",
                     min = 100,
                     max = 5000,
                     value =20),
sliderInput("iter",
            "Iterations",
            min = 100,
            max = 2000,
           value = 20),
sliderInput("bins",
            "Number of Bins",
            min = 1,
            max = 50,
            value = 30)
      ),

      # Show a plot of the generated distribution
      mainPanel(
         plotOutput("distPlot"),
         plotOutput("distLine")
      )
   )
))

# Define server logic required to draw a histogram
server <- shinyServer(function(input, output){

   output$distPlot <- renderPlot({
     gamblers = rep(10000,input$size)
     for (i in 1:input$iter){
       gain = (2*rbinom(input$size, 1, input$winp) -1)*input$bid
       gamblers[gamblers>=input$bid] <- gamblers[gamblers>=input$bid] + gain[gamblers>=input$bid]
       gamblers[gamblers>100000] <-100000
     }
    bins <- seq(min(gamblers), max(gamblers), length.out = input$bins + 1)

      # draw the histogram with the specified number of bins
      hist(gamblers, breaks = bins, col = 'darkgray', border = 'white', ylim = c(0,input$size),
           xlab = "Wealth")
   })
   output$distLine <- renderPlot({
     gamblers = rep(10000,input$size)
     for (i in 1:input$iter){
       gain = (2*rbinom(input$size, 1, input$winp) -1)*input$bid
       gamblers[gamblers>=input$bid] <- gamblers[gamblers>=input$bid] + gain[gamblers>=input$bid]
       gamblers[gamblers>100000] <-100000
     }
     bins <- seq(min(gamblers), max(gamblers), length.out = input$bins + 1)
     # draw the histogram with the specified number of bins
     plot(sort(gamblers), type = 'l', xlab= "Wealth", ylab = "Number of Gamblers")+
       abline(h = 10000, col = "red")

   })
})

# Run the application
shinyApp(ui = ui, server = server)
```

[https://starry.shinyapps.io/post02-Tianshu-Zhao/] (Shiny cannot run in html, so I post the webite in here, you can click the website in order to open it)

Explanation

We need to understand the common mistake of thinking this problem is: ***Even if the odds of winning a game are 50 percent, it does not mean that 50 percent of people win or 50 percent people lose money, or the gamblers can make balance payment in the end.*** # **Assumption** Let's say there are 1,000 players, and each of them has 10,000 dollars in each hand, which can be used to gamble. - ### Each game, the player can mortgage $500 to play, if lose,the chips will not be returned; if win, the player can get double amount of the chips he uses to bet. - ### The probability of win and lose are both 50% - ### All players will play 100 games, once any player has a $0 left, they must drop out of the game immediately.

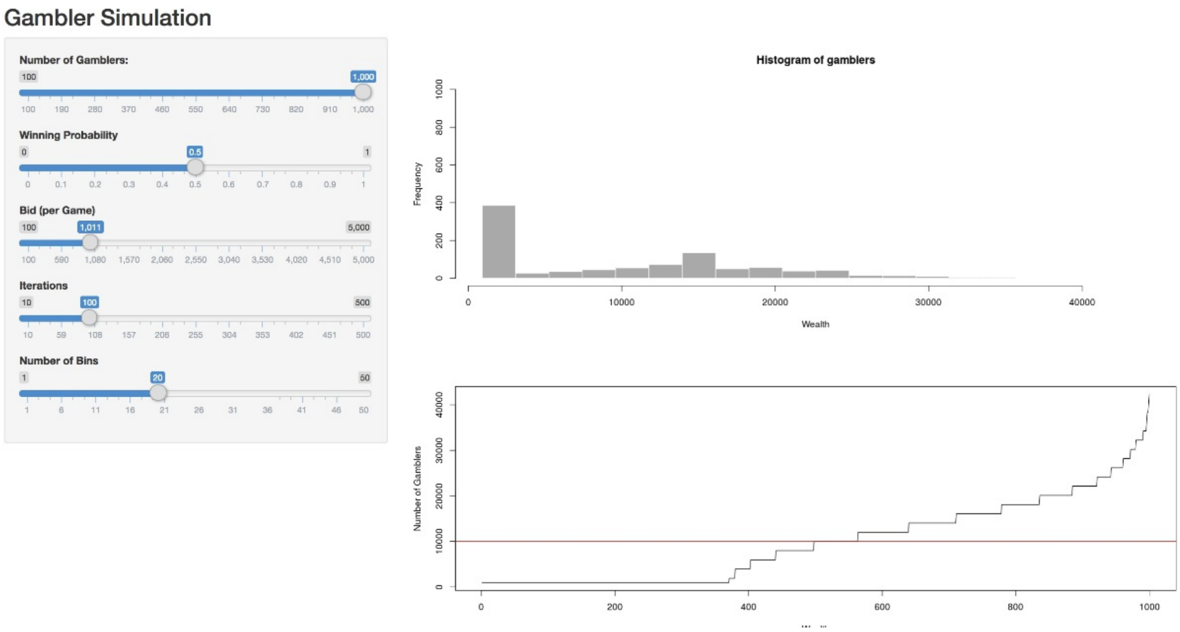
Let's see what happen to people's wealth distribution after we play the game 100 times.



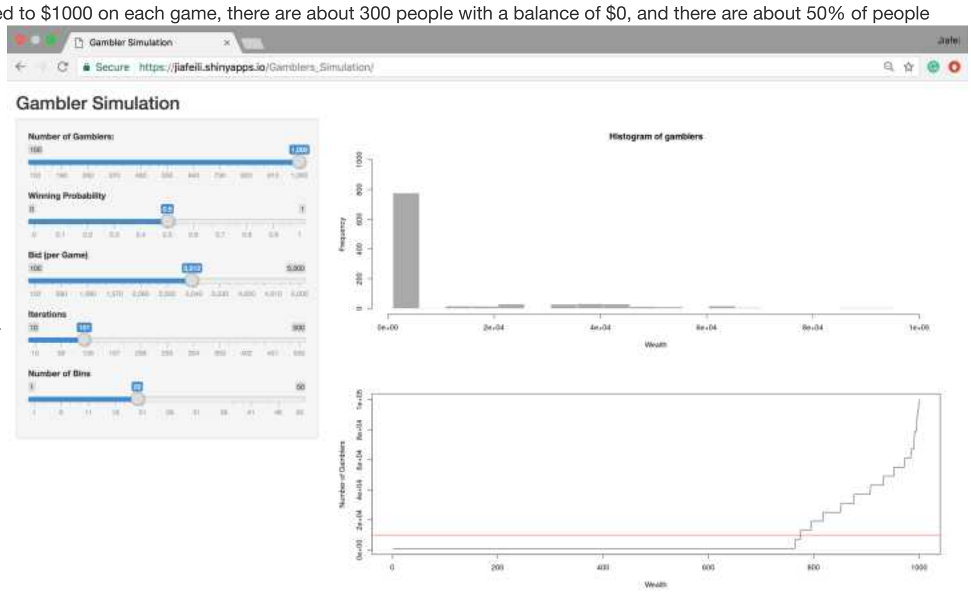
The red line in the picture above represents the initial funds $10,000 position. We can see, at this time, the wealth distribution is quite in average, and **about 55% of people has $10,000 and above**

Experiment

As we mentioned before, the bet of each game is $500, what would happen to the result if we add more money on each drop?



When the bets are increased to $1000 on each game, there are about 300 people with a balance of $0, and there are about 50% of people



whose balance is $10,000 .

After the bets increased to $3000, at the end of the game , there are nearly 800 people with the balance of $0, and there are about 20%-25% of people have balance $10,000 and above.

Conclusion

From the model above, we know that gambling is not a good way for fun, and even the most fair bet is not likely to make every bet even. You can gamble with entertainment, and if you do not mind lose money, you can play it in the long run just for fun. However, if you do not know the winning odds, and you do not know how to control, you want to make a fortune and get rich through gambling, then the results must be crushing defeat unless you are a statistician like me. :)

image

Reference

1.[https://www.theguardian.com/society/2017/aug/30/problem-gamblers-spend-more-money-place-more-bets-play-at-night]
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3.[http://blog.infographics.tw/2016/04/interactive-r-with-shiny/]
4.[http://readata.org/portfolio/shiny-app-with-r/]
5.[https://github.com/ariel1995zhao/stat133-hws-fall17_r/blob/master/Final%20pic%20(1).jpg]
6.[https://www.guokr.com/article/33711/]
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