Snakes and Ladders

Suraj Nath

Feb. 19, 2017

Snakes and Ladders Game Simulation

Problem Statment

Consider the following snakes-and-ladders game. Let N be the number of tosses to reach the finish using a fair dice. Write a R program to calculate the expectation of N . Also, draw a plot in which the x -axis shows the number of rolls, and the y -axis shows the percentage of games that were completed in that number of rolls.

Code

The ladders and slides/snakes will be set up as a data frame,

```
ladder.df <- data.frame(start=c(3,11), end=c(13,17))
slide.df <- data.frame(start=c(10,16,18), end=c(5,2,8))
```

```
library(knitr)
```

The ladders:

```
kable(ladder.df, align="c")
```

start	end
3	13
11	17

The Snakes:

```
kable(slide.df, align="c")
```

start	end
10	5
16	2
18	8

```
library(foreach)
library(doParallel)
```

```
## Loading required package: iterators
```

```
## Loading required package: parallel
```

```
registerDoParallel(cores=4)
```

```
getDoParWorkers()
```

```
## [1] 4
```

```
num.iter <- 100 # Number of play throughs aka games

# Get timing as well
stime <- system.time({
  out.seq <- foreach(icount(num.iter), .combine=rbind) %do% {
    curLoc <- 0
    nroll <- 0
    slides <- 0
    ladders <- 0
    # Keep rolling dice and moving until reach 17 or greater ending the game
    while(curLoc < 17) {
      roll <- sample(6,1) # generate random number between [1 to 6]
      curLoc <- curLoc + roll # increase position
      nroll <- nroll + 1 # increase number of rolls
      # Need to check if we landed on a ladder or slide and move forward or back
      if (any(ladder.df$start %in% curLoc)) {
        curLoc <- ladder.df$end[ladder.df$start %in% curLoc]
        ladders <- ladders + 1
      }
      if (any(slide.df$start %in% curLoc)) {
        curLoc <- slide.df$end[slide.df$start %in% curLoc]
        slides <- slides + 1
      }
    }
    # Create output to store, num rolls, num ladders hit, num slides hit
    out.info <- c(nroll, ladders, slides)
  }})[3]
```

Time taken by simulation

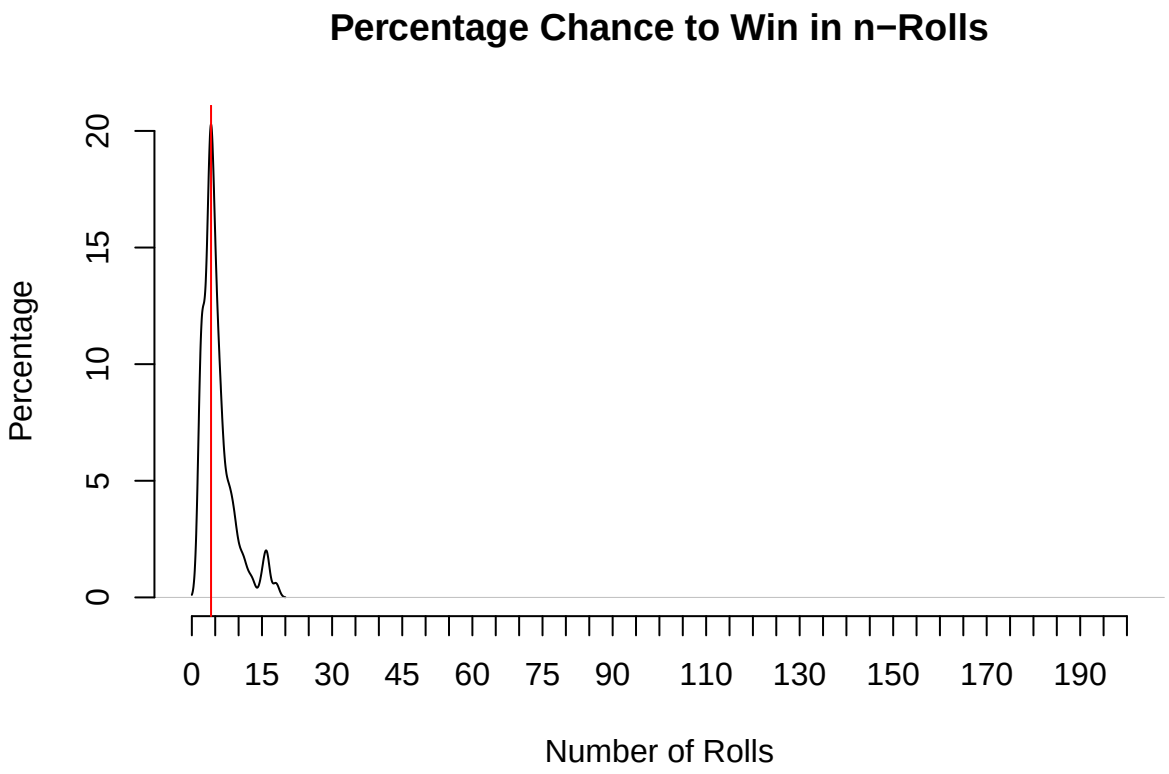
```
stime
```

```
## elapsed
##    0.07
```

Output

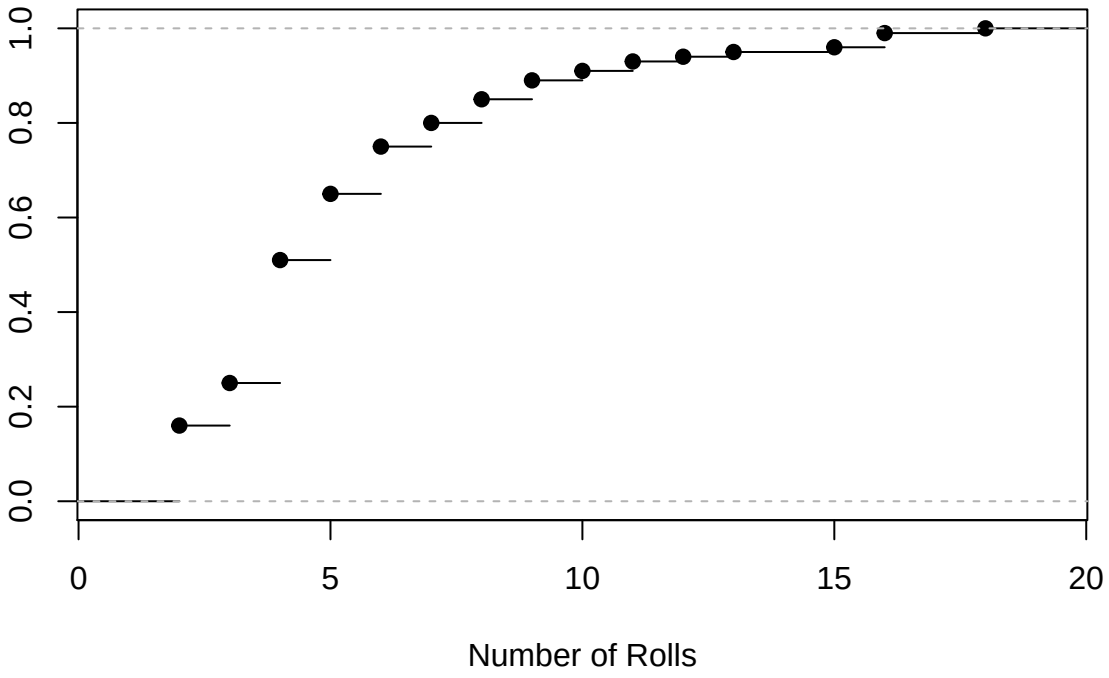
Plot for percentage chance to win the game in n rolls:

```
d <- density(out.seq[,1])
d$y <- d$y * 100
plot(d, main="Percentage Chance to Win in n-Rolls", xlab="Number of Rolls", ylab="Percentage", xlim=c(0
axis(2)
axis(1, at=seq(0,200,5))
abline(v=d$x[which.max(d$y)], col="red")
```



cumulative distribution function:

```
plot(ecdf(out.seq[,1]), xlab="Number of Rolls", ylab="",main="")
```



Conclusion

In this assignment we learned about simulation, system variables, simulation clock etc.

I also created a full scale sankes and ladders simulation which can be found on my github account (https://github.com/electron0zero/R-projects/tree/master/snakes_and_ladders)