Colorful Puzzles

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4/28/2017

I will solve this problem by simulation. I will assume that a turn counts as round where you draw the first ball, and then the second to paint that ball to be the same color as the first. I will first write a function that plays this game once and returns the number of turns it takes.

```
play_game <- function() {
    n.turns <- 0
    balls <- c("red", "blue", "green", "yellow")
    while(length(unique(balls)) > 1){
        possible.balls <- 1:4
        ball.samples <- sample(possible.balls, 2, replace = FALSE)
        balls[ball.samples[2]] <- balls[ball.samples[1]]
        n.turns <- n.turns + 1
    }
    return(n.turns)
}
```

And now we can play the game 100,000 times, keeping track of the number of turns it takes to complete each game. I set a seed so that we get consistent results each time we do this simulation.

```
n <- 100000
results <- rep(0, n)
set.seed(4282017)
for(i in 1:n){
    results[i] <- play_game()
}
```

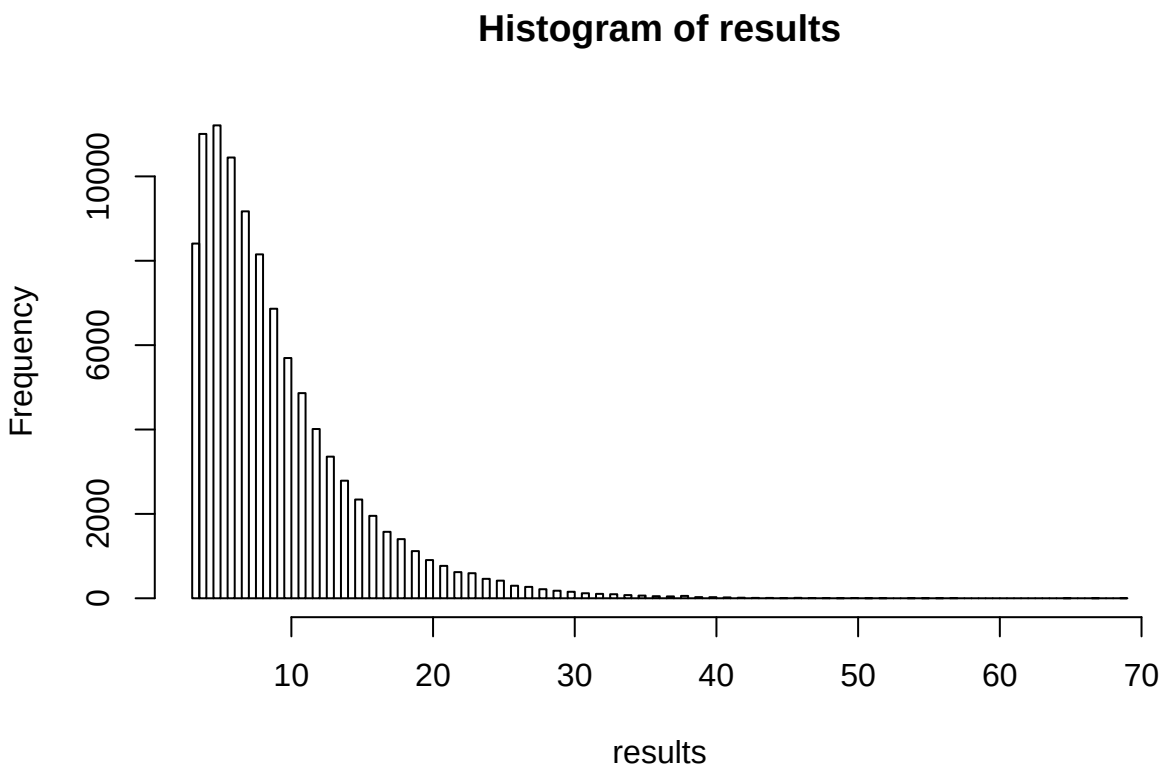
We can then take the mean of the number of times it took to complete each game, which should be approximately the expected number of turns it takes to finish a game

```
mean(results)
```

```
## [1] 9.00877
```

We see that the expected value is about 9 times! We can also easily visualize the distribution of the number of times it takes to complete each game.

```
hist(results, breaks = 100)
```


Histogram of results
Frequency
0
2000
6000
10000
10
20
30
40
50
60
70
results