Stat 550, Spring 2019
Lab #1 Jan Domingo

For this lab, we will run some simulations of rolling dice and tossing coins using the statistical software program R. Your solutions should contain clearly identified numerical answers and well labeled tables/figures, where appropriate. Make sure to include clear and concise interpretations of any values, figures, and responses to queries posed. Place all code in an appendix, at the end of your solutions document.

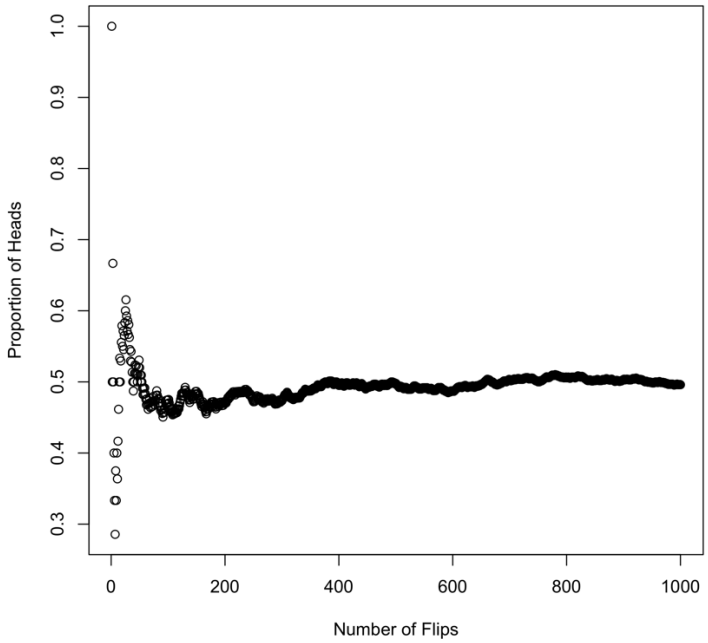
1. Suppose we run an experiment to estimate the probability of obtaining a heads when flipping a coin based on an n number of flips.
   a) Run this simulation for 10, 100, 500, and 100 flips

      See attached appendix.

   b) For each simulation in a), calculate the estimated proportion of heads that you obtained from n flips.

      We obtained the following estimated proportions for each simulation of 10, 100, 500, and 1,000 flips respectively: 0.5, 0.49, 0.498, and 0.522.

   c) Plot the cumulative proportion of heads versus number of coin toss for the simulation of 1,000 flips. Describe what you notice about the proportion of heads as the number of flips increase.



      We notice that as the number of coin flips increase (in other words the number of trials), the estimated proportion of heads get closer to the true proportion of 0.5

2. In a game of craps, snake eyes is the event of rolling two 1's from a pair of dice.

a) Calculate by hand the theoretical (true) probability of rolling a sum of 6

P(snake eyes) = $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36} = 0.0278$

b) Use R and simulate 1,000 rolls of a pair of dice. From these rolls, estimate the proportion of pairs that were snake eyes

For our simulation of 1,000 rolls, we obtained an estimated proportion of 0.033 chance of obtaining snake eyes.

c) Compare the true probability from a) within your empirical probability from b)

Our empirical proportion was more than the theoretical probability. Thus for 1,000 rolls, the sample proportion is close to that of the true proportion with an absolute difference in error of .0052.

Appendix

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#R Code for Lab 1


#1

#(a) (b)


n = 10 #number of trials

simFlips = sample(0:1, n, replace=TRUE) #Simulate a coin flip n times

simHeads = sum(simFlips==1)

propHeads = sum(simHeads)/n #calculate the proportion of heads


n = 100 #number of trials

simFlips = sample(0:1, n, replace=TRUE) #Simulate a coin flip n times

simHeads = sum(simFlips==1)

propHeads = sum(simHeads)/n #calculate the proportion of heads


n = 500 #number of trials

simFlips = sample(0:1, n, replace=TRUE) #Simulate a coin flip n times

simHeads = sum(simFlips==1)

propHeads = sum(simHeads)/n #calculate the proportion of heads


n = 1000 #number of trials

simFlips = sample(0:1, n, replace=TRUE) #Simulate a coin flip n times

simHeads = sum(simFlips==1)

propHeads = sum(simHeads)/n #calculate the proportion of heads
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#(c)
# Plot the cumulative proportion of heads for 1,000 flips
#Use the same results from (a)
n = 1000 #number of trials
simFlips = sample(0:1, n, replace=TRUE) #Simulate a coin flip n times
cumulHeads = cumsum(simFlips==1)
cumulProp = cumulHeads/c(1:n) #calculate the proportion of heads
#Plotting the cumulative proportions versus the number of rolls
plot(cumulProp, xlab="Number of Flips", ylab="Proportion of Heads")



#============================================
#2
#(b)
n = 1000 #number of trials
#Simulate and sum n dice rolls
simFlips = replicate(n, sum(sample(1:6, 2, replace=TRUE)))
#Find the number of pairs that were snake eyes
sum2 = sum(simFlips==2)
#Find the proportion of snake eyes
sum2Prop = sum2/n
```