Lab 2: Throwing dice

due date: Friday, September 22 in class

Introduction

This week you will complete a short R lab that involves rolling dice and computing sums, and tossing coins. Again and again and again. This is why we use R. Each question is worth 5 points.

You will be graded both on correctness of your answers and on the presentation of your answer. This means you need to *explain* your methodology well.

A list of useful R commands is included as the last page of this handout. You will need to modify the commands to your purposes. A copy of this file is available on the class webpage, if you want to use something like WORD for your write up, or to cut and paste commands.

Problems

1. In this problem, you will explore the sum of the roll of three dice. For sample sizes, try $n = 10, 25, 50, 100$ or other values n of your choice. Suppose you roll the three dice and sum the outcomes repeatedly. If you were to earn a \$1 for the sum, for instance, then a roll of 1,1,1 earns you \$3.

   How much do you expect to earn in an average game? Carefully, explain your answer and methodology below.

2. You toss a *biased* coin repeatedly, with the probability of heads, $P(H) = p$, for some unknown value of p. Your goal is to give the best estimate of p that you can. To that end, suppose you flip this coin twice and that you earn \$1 each time a H comes up, and \$10 each time a T comes up.

   There are 4 data sets available for you. They are called *earningsSampleSizeN* where $N = 10, 100, 1000, 10000$. Again, your task is to give the best estimate for p you can give from these datasets and explain how you arrived at your answer.

   I estimate the value of p to be _____.

Helpful commands from R:

```
# generate 10 random rolls of a di with values between 5 and 9
        d10=floor(runif(10,min=5,max=10))

# more or less the contents of my R file names dice.R
        sampleSize<-10
        numberDice=7

        sumOfDice=rep(0,sampleSize)

        str=sprintf("Generating %d samples of the experiment   'Find the sum of %d dice'  ",
             sampleSize,numberDice)
        print(str)

        for (ii in 1:sampleSize){
           sumOfDice[ii]=sum(floor(runif(numberDice,5,11)))
           #print(sumOfDice[ii])
        }
        if (sampleSize<1000){
          print(sumOfDice)
        }
# end of batch file dice.R

# how to execute the commands in dice.R
        source("dice.R")

# reminder for making histograms
        hist(d10,seq(.5,6.5,1))
        hist(d10,seq(.5,6.5,1),freq=T)
        hist(d10,seq(.5,6.5,1),freq=F)


# how to load the datasets with earnings, or load and save to a variable
        scan(file="earningsSampleSize10")
        earnings100=scan(file="earningsSampleSize100")
        ....
```