

## 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, 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 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")
....
```