Dice Lab - Leila Erbay

**Instructions:**

* Read the lab all the way through
* Complete the lab
* Clearly label all .R scripts and submit relevant scripts and files

First we will start with a simple experiment in which we throw a standard (6 sided) die 5 times.

a) Write down one possible event (set of outcomes) for this experiment:

A = {12345}

b) What is the probability of observing the event you described?

S= 6^5

P(A) = 1 / 6^5

c) Describe the sample space (Please don’t write it all down!)

What is the size of this sample space?

Sample space is all possible choices: (1...6)(1..6)(1..6)(1...6)(1...6)(1...6)

size of sample space = 6^5

**PAUSE HERE, CHECK ANSWERS WITH CLASS, BRING FORWARD ANY QUESTIONS**

d) What is the expected value of the number we obtain from a roll of the die?

x 1 2 3 4 5 6

P(x) 1/6 --> 1/6

E[X] = 1(1/6) + 2(1/6) + 3(1/6) + 4(1/6) + 5(1/6) + 6(1/6) = 3.5

E[x] = Sum(x \*P(x))

e) What is the expected value of the total number we will get from each experiment (the sum of the outcome of the five consecutive rolls)?

E[xTotal] = 5\*3.5 = 17.5

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**WE WILL DO PART(f) TOGETHER**

f) Now we will simulate this experiment (of rolling a six-sided die 5x) many times on your computer.

Make a random, uniform distribution of the six integers with R

Hint: try using sample.int() – be sure to set the replace argument equal to TRUE

What is the average of 10 experiments? 100 experiments? 1000 experiments?

Ave of 10 experiments: 18.9

Ave of 100 experiments: 17.61

Ave of 1000 experiments: 17.489

g) Was this number identical to your result in (e)? Why?

What happens to the average as you increase the number of experiments?

No, the numbers differed than the results in e because each trial is independent and thus the values of the sums from each trial will be different.

Average goes closer to the value of 17.5

h) Christina and Vignesh are carrying out this experiment. They obtain {6,5} (first roll 6, second roll 5) in the first two rolls of the die.

Vignesh knows that the expected value of the five rolls is 17.5, so he argues that the next three rolls should be lower than average to balance out the first two rolls.

Christina is not so sure. Who is right and why?

Christina is correct because each trial is independent thus the values of the sums from each trial will vary. The average may hit 17.5, but there is possibility it will not.

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i) What is the conditional expectation of the sum of the die in Vignesh’s and Christina’s experiment?

(6+5 +3.5+3.5+3.5) = 21.5

**REVIEW THIS QUESTION WITH THE CLASS**