

Homework 6

Due Friday, November 5, 2021

Math 205

1. There are five green balls, four yellow balls, and two blue balls in a bin. You draw two of them out at random.

- (a) Calculate the probability that both are green, the probability that just one is green, and the probability that neither one is green.
- (b) Write a program to simulate the experiment 10,000 times, count how many times each outcome occurs, and report the result. You'll want to start with

```
from random import *  
L = ["G", "G", "G", "G", "G", "Y", "Y", "Y", "Y", "B", "B"]
```

or if you're feeling fancy, that second line could be

```
L = ["G"]*5 + ["Y"]*4 + ["B"]*2
```

To pick two of them at random, you could either do `shuffle(L)` to shuffle the list and then examine `L[0]` and `L[1]`, or you could do `M = sample(L, 2)` and then examine `M[0]` and `M[1]`.

- (c) If your calculation and your program don't agree, go back and correct the calculation, or the program, or both.

2. You draw two cards at random from a standard deck.

- (a) Calculate the probability that they have the same rank (ace, 2, 3, ..., 10, jack, queen, king), and the probability that they have the same suit (clubs, diamonds, hearts, spades).
- (b) Write a program to simulate the experiment 10,000 times and report the result. For the suit question, you can ignore the ranks and just start with something like

```
L = ["C", "D", "H", "S"]*13
```

Similarly, for the rank question you can ignore the suits.

- (c) If your calculation and your program don't agree, go back and correct the calculation, or the program, or both.

3. You roll two six-sided dice.
 - (a) Calculate the probability that they add up to 9 or more.
 - (b) Write a program to simulate the experiment 10,000 times and report the result. To get a random integer between 1 and 6, you can use either `randrange(1,7)` or `randint(1,6)`.
 - (c) If your calculation and your program don't agree, go back and correct the calculation, or the program, or both.
 - (d) Challenge: What if it's three dice adding up to at least 15?
4. You flip a coin ten times.
 - (a) Calculate the probability that it comes up heads 7 or more times.
 - (b) Write a program to simulate the experiment 10,000 times and report the result. You could do `L = ["H", "T"]` and then use `choice(L)` to get a random choice, but it would be slicker to let 0 represent tails, let 1 represent heads, and add up the random choices to get the number of heads.
 - (c) If your calculation and your program don't agree, go back and correct the calculation, or the program, or both.
5. Optional challenge problem: random walks. A bug starts at the origin on a number line. It flips a coin to decide whether to move one unit left or right. It does this many times.
 - (a) What is the probability that after 20 steps, the bug is more than 10 units away from the origin? Don't try to compute this by hand, but write a program to approximate the answer.
 - (b) What is the average distance that the bug will end up at after 20 steps? Again write a program to approximate the answer.
 - (c) What if the bug walks randomly in the xy -plane, each time moving either left, right, up, or down? Do you expect your answers to (a) and (b) to get bigger or smaller? Write a program to see if you were right.