1. Define “random variable” in your own words.
   A random variable quantifies the outcomes of an event occurring.
2. Suppose I told you that “X is a random variable with possible values ‘red’ and ‘green’ ”. What is wrong with this statement?
   Red and green cannot be counted.
3. Consider the sample space of an experiment in which three coins are flipped. The outcomes are HHH, HHT, etc. Make a list or picture of all the outcomes in the sample space.

   HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

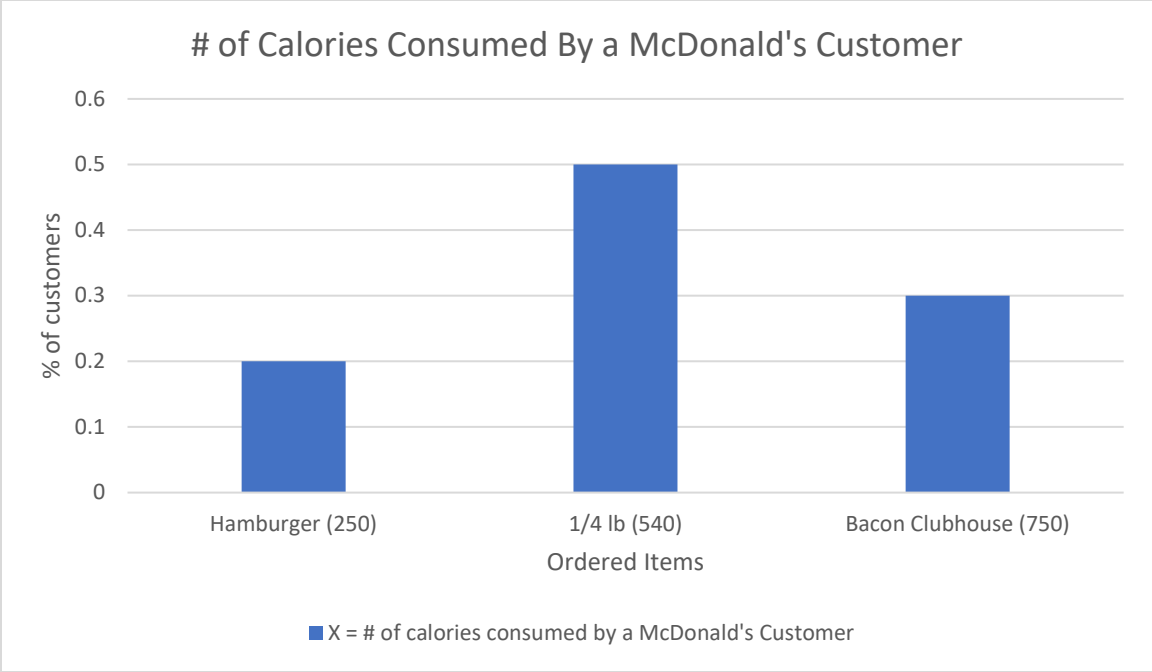
4. Using the sample 3-coin flip example, let random variable X be the number of heads in the 3 flips. For each possible value of X, make a mark next to the elements of the sample space having that value.

S	X
HHH	3
HHT	2
HTH	2
HTT	1
THH	2
THT	1
TTH	1
TTT	0

5. Using the 3-coin flip again, what is P(X = 2)? What is P(X > 1)?
   a. **P(X =2) = 3/8**
   b. **P(X > 1) = 1/2**
6. Let Y be 1 if the first coin of a three-coin flip is heads, and be 0 if the first coin is tails. For each outcome in the sample space, what is X + Y?

S	X	Y	X+Y
HHH	3	1	4
HHT	2	1	3
HTH	2	1	3
HTT	1	1	2
THH	2	0	2
THT	1	0	1
TTH	1	0	1
TTT	0	0	0

7. What is P(X + Y = 3)?
   a. **= ¼**
8. Assume that every McDonald's customer buys only one item and that 20% get a hamburger (250 calories), 50% get a quarter pounder with cheese (540 calories), and 30% get a bacon clubhouse burger (750 calories). Let random variable X be the number of calories consumed by a McDonald's customer. Draw a PMF for the distribution of X.



9. Using the figures in 8, how many calories does a typical McDonald's customer consume per visit?
   250 * 0.2 + 540 * 0.5 + 750 * 0.3 = 545
10. Now we'll write code to simulate. Create an array of length 1000 representing samples from random variable X of problem 8. What is the average of the values in your array? How does this value compare to the result you got for the previous problem?

```
11.      import numpy as np
12.
13.      calories = np.random.choice([250,540,750], size=1_000, p=[0.2,
   0.5,0.3])
14.      calories.mean()
```

15. If you still have time, use Bayes' Rule to solve the conditions problem near the end of the lecture on conditional probability. You can do this by hand.
16. If you still have time, download the free text Introductory Statistics with Randomization and Simulation (Links to an external site.), and find something that interests you in Chapter 1. Find a problem and see if you can solve it, with or without coding.