LARSON—MATH 255–CLASSROOM WORKSHEET 21
Coin Flip Experiments.

1. (a) Start the Chrome browser.
   (b) Go to `http://cocalc.com`
   (c) Login using **your VCU email address** .
   (d) Click on our class Project.
   (e) Click "New", then "Worksheets", then call it **c21**.
   (f) For each problem number, label it in the Sage cell where the work is. So for Problem 2, the first line of the cell should be `#Problem 2`.

   Coin Flip Questions

   - If you flip a coin 100 times, you would expect about 50 heads. Its possible that you could get 100 heads. But this would be rare. How rare? We can *simulate* flipping a coin a hundred times, write down how many heads we got, and then repeating this experiment. This will give us a *distribution* of various possible outcomes.
   - When you flip a coin 100 times would you expects to see 6 heads or tails in a row at some point? We can investigate this question by simulating coin flips and repeating our *experiment* a number of times.

2. Use your `coin_flip()` function (from previous classes) to define a new function `coin_flips(n)` which *returns* a **list** of n random H's or T's (representing the result of n coin flips).

```
def coin_flips(n):
  flip_results = []
  for i in [1..n]:
      flip_results.append(coin_flip())
  return flip_results
```

   Check that it works.

3. Now define a function `number_of_heads(n)` that counts and *returns* the number of heads you get after flipping a coin n times.

4. Write a function `heads_tails(n)` which *prints* the numbers of both heads and tails you get after flipping a coin n times.

5. **Problem: If you flip a coin 100 times, you would expect about 50 heads. Its possible that you could get 100 heads. But this would be rare. How rare?** Let one *experiment* be a flip of 100 coins. Do the experiments and record the number of heads in a list called `experiment_results`. Do 1000 experiments total (that is, 1000 repetitions of a single 100-flip experiment) and record each result (how many heads there were) in your list.

6. Use `histogram(experiment_results)` to visualize the results from all of these experiments.

Streaks of Heads and Tails

7. Now we need to find a longest streak of heads or tails in our data. One way to do it it to first find the length of the streak that starts at any specified index in your `flip_data`. Define a function `streak_at_i(flip_data,i)` that inputs a list of 'H' and 'T' strings, an index i, and returns the length of the streak whose first term is `flip_data[i]`. Test it on some data to see if its working.

8. Now we have a tool we can to a longest streak of heads or tails in our data. Use `streak_at_i(flip_data,i)` for $i \in [0..99]$ and keep track of the largest value you get.

A Formula for Primes?

9. When $n = 0$, $n^2 - 79n + 1601$ is 1601—which is prime. When $n = 1$, $n^2 - 79n + 1601$ is 1523—which is prime. Find the smallest value of n where $n^2 - 79n + 1601$ is *not* prime.

Getting your classwork recorded

When you are done, before you leave class...

(a) Click the "Make pdf" (Adobe symbol) icon and make a pdf of this worksheet. (If Cocalc hangs, click the printer icon, then "Open", then print or make a pdf using your browser).

(b) Send me an email with an informative header like "Math 255 - c21 worksheet attached" (so that it will be properly recorded).

(c) Remember to attach today's classroom worksheet!