LARSON—MATH 255–CLASSROOM WORKSHEET 20
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 **c20**.

   (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`.

   It is often useful to generate **random integers**. It only makes sense to generate random integers from within some range of integers. We do this with `randint()`.

2. Evaluate `randint(5,100)` a few times; your results will vary. This will generate random integers in the range $[5, 100]$, including both endpoints.

3. **Investigate**. Does `randint()` produce a *uniform distribution*? (That is, as you repeat experiments of `randint(a,b)` are the number of produced outcomes of each possible integer roughly the same? Do some experiments! How will you keep track of the data?)

4. Define a function `randint_experiments(n)` that evaluate `randint(5,100)` n times, finds the difference between the *percentage* of this number that occurs most frequently and the one that occurs least frequently, and returns that difference. If `randint` is uniform this difference should approach 0 as n get large.

5. Sketch the results of `randint_experiments(n)` for increasing values of n.

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.

6. 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.

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

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

9. **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.

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

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 - c20 worksheet attached" (so that it will be properly recorded).

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