LARSON—MATH 353–CLASSROOM WORKSHEET 09
Getting Started—Faking Data.

1. Log in to CoCalc.

   (a) Start the Chrome browser.

   (b) Go to `https://cocalc.com`

   (c) Login (**your VCU email address** is probably your username).

   (d) You should see an existing Project for our class. Click on that.

   (e) Click "New", then "Worksheets", then call it **c09**.

2. **A problem to think about: Faking Data:**. If you flip a coin 100 times and record the data, what would you *expect* the data to look like? How long on average will the longest streak of heads or tails be? In faked data, these tend to be short.

   How can we write a program to simulate 100 coin flips, and then to determine if the results contain a streak of at least 6 heads or at least six tails?

   Run lots of experiments and record the percentage of experiments with a streak of least 6 heads or at least six tails?

   More: What is the average length of a longest streak in a 100-flip experiment?

Matrices

3. We can represent the system of linear equations $\begin{cases} 2x + y = 5 \\ x + 3y = 7 \end{cases}$

   with the matrix $A = \begin{bmatrix} 2 & 1 & 5 \\ 1 & 3 & 7 \end{bmatrix}$

   Enter this in Sage using: A=matrix(2,3,[2, 1, 5, 1, 3, 7])

   Use A.rref() to find a matrix that represents an equivalent system in *row-reduced echelon form.*

4. Consider the system: $\begin{cases} x + 3y = 5 \\ x + 3y = 7 \end{cases}$

   Find a matrix that represents this system, find the row-reduced echelon form of this matrix, rewrite this as an equivalent system of linear equations and interpret.

5. Consider the system: $\begin{cases} x + y = 5 \\ 2x + 2y = 10 \end{cases}$

   Find a matrix that represents this system, find the row-reduced echelon form of this matrix, rewrite this as an equivalent system of linear equations and interpret.

6. Consider the system: $\begin{cases} 9a + 3b + 1c = 32 \\ 4a + 2b + 1c = 15 \\ 1a + 1b + 1c = 6 \end{cases}$

   Find a matrix that represents this system, find the row-reduced echelon form of this matrix, rewrite this as an equivalent system of linear equations and interpret.

7. Let A=matrix(2,2,[1,2,3,4]), and b=vector([5,6]). Solve the matrix equation $A\hat{x} = \hat{b}$ using A.solve_right(b)

   Programming

   A *for loop* is what we use when we want our code to run through every item x in a list.

8. The function `list_evens(n)` that returns all the even integers from 0 to n. Evaluate and test the following code.

```
def list_evens(n):
    M=[]
    for x in [0..n]:
        if x%2==0:
            M.append(x)
    return M
```

9. Write a function list_primes(n) that **returns a list** of all the primes up to n. Test it.

10. Write a function count_primes(n) that **returns a count** of all the primes up to n. Test it.

11. **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 353—c09 worksheet attached" (so that it will be properly recorded).

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