

LARSON—MATH 353—CLASSROOM WORKSHEET 08
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 **c08**.

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?

Tuples

A *tuple* is a Sage object, similar to a list, but with curved brackets instead of square brackets. These include pairs like $(2, 3)$, triples like $(4, 5, 6)$, etc.

3. Let `t=(2,3)`. Then evaluate `t`, and evaluate `type(t)`.
4. You can find the entries in a tuple just like you can with a list. Try `t[0]`, `t[1]` and `t[2]`.

A tuple in Sage is an *immutable* object. You can't change it.
5. Try to change the 0^{th} entry of `t`. Evaluate `t[0] = 5`.

Anonymous Functions

An *anonymous function* is just a function without an associated name and, thus, not meant for reuse. They can be useful in order to save defining an auxiliary function (especially if you have no intention of using that auxiliary function for anything else).

6. We want to triple all the entries of some list. We could do the following:

```
f(x)=3*x
[f(x) for x in [4,5,6]]
```

Equivalently we could use a “lambda construction” and define an *anonymous function*:

```
[(lambda x: 3*x)(x) for x in [4,5,6]]
```

Now define an anonymous function to create a list of squares of every element of $[4, 5, 6]$.

7. Define a function `filter_evens(L)` that takes a list L of integers as input and returns a new list which is exactly the even integers that were in L . Test it.
8. Suppose you only intended to do this once ever. Then you don't need to define a function. If you wanted to filter the even integers from $L = [1, 2, 3, 4, 5, 6]$ you could do the following:

```
[x for x in L if x%2==0]
```

9. `is_prime()` is a built-in Sage function which tests if an integer is prime. Try `is_prime(5)`, `is_prime(6)`, `is_prime(47)`, and `is_prime(34567)`
10. Now write a function that inputs a list of integers L and outputs a list of the primes from L .

Sets

11. Let $L = [2, 3, 3, 3, 2, 1, 8, 6, 3]$ and $A = \text{Set}(L)$. Evaluate A . What happened?
12. Find how many elements set A has with `A.cardinality()`.
13. Try: `8 in A`. What do you get? Try: `9 in A`.
14. Let $B = \text{Set}([8, 6, 17, -4, 20, -2])$. Try `A.union(B)`. What do you get?
15. Try `A.intersection(B)`.
16. Let $R = 1, 2, 3$, and $S = 2, 3, 4$. What is the set $R - S$? Try `R.difference(S)` and `S.difference(R)`.

17. 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—c08 worksheet attached” (so that it will be properly recorded).
- (c) Remember to attach today's classroom worksheet!