

LARSON—MATH 255—CLASSROOM WORKSHEET 07
Anonymous Functions, Tuples, Sets, Matrices.

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 **c07**.
(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`.
2. **Warm-ups.** What will the following commands return in Sage? Answer and then use Sage to check.

- (a) `is_prime(2**(2**4)+1)`
- (b) `is_prime(2**(2**5)+1)`
- (c) `L=[1, 2, 1, 2,1]`
- (d) `len(L)`
- (e) `S=set(L)`
- (f) `len(S)`
- (g) `[k**k for k in L]`

Anonymous Functions

An *anonymous function* is just a function without an associates 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).

3. 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 square every element of `[4, 5, 6]`.

More Lists

A list in Sage is a *mutable* object. Its entries can be changed.

4. Let `L=[1, 2, 1, 2,1]`. Evaluate `L[0]` (you will get the 0th entry of `L`; it should be 1).
5. `L[0]` can be changed. Evaluate `L[0]=5`. Now evaluate `L`.
6. Let `L = [2,3,3,3,2,1,8,6,3]`. Try `L.sort()`. What does Sage do?
7. Try `L.append(4)`. Evaluate `L`.

8. Try `L.remove(3)`. What do you get?
9. Try `sum(L)`. What do you get? What did Sage do?
10. Try `prod(L)`. What do you get? What did Sage do?
11. Try `[cos(x) for x in [0, pi/4, pi/2, 3*pi/4, pi]]`. What do you get? Explain.
12. Try `[factorial(x) for x in [1,2,3,4,5]]`. What do you get? Explain?
13. What do you think the value of `sum([exp(x) for x in [1,2,3,4,5]])` will be? Try it.

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.

14. Let `t=(2,3)`. Then evaluate `t`, and evaluate `type(t)`.
15. 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.
16. Try to change the 0th entry of `t`. Evaluate `t[0] = 5`.

Sets

17. Let `L = [2,3,3,3,2,1,8,6,3]` and `A=Set(L)`. Evaluate `A`. What happened?
18. Find how many elements set `A` has with `A.cardinality()`.
19. Try: `8 in A`. What do you get? Try: `9 in A`.
20. Let `B = Set([8,6,17,-4,20, -2])`. Try `A.union(B)`. What do you get?
21. Try `A.intersection(B)`.
22. Let `R = {1, 2, 3}`, and `S = {2, 3, 4}`. What is the set `R-S`? Try `R.difference(S)` and `S.difference(R)`.

Matrices

23. 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])`. Evaluate `A`.

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—c07 worksheet attached” (so that it will be properly recorded).