LARSON—MATH 255–CLASSROOM WORKSHEET 06
Anonymous Functions, Tuples, Sets, Matrices

1. Log in to your Sage/Cocalc account.

   (a) Start the Chrome browser.

   (b) Go to `http://cocalc.com` and sign in.

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

   (d) Click "New", call it **c06**, then click "Sage Worksheet".

   (e) For each problem number, label it in the Sage cell where the work is. So for Problem 1, the first line of the cell should be `#Problem 1`.

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
   map(f,[4,5,6])
   ```

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

   ```
   map(lambda x: 3*x,[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 map(cos, [0, pi/4, pi/2, 3*pi/4, pi]). What do you get? Explain.

12. Try map(factorial,[1,2,3,4,5]). What do you get? Explain?

13. What do you think the value of sum(map(exp,[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.