LARSON—MATH 255–CLASSROOM WORKSHEET 06
Lists, Calculus, Tuples, Matrices

1. Create a Cocalc/Sage Cloud account.
   (a) Start the Chrome browser.
   (b) Go to `http://cocalc.com`
   (c) "Create new account" using **your VCU email address** .
   (d) You should see an existing Project for our class. Click on that.
   (e) Click "New", then "Sage Worksheet", then call it **c06**.
   (f) For each problem number, label it in theSAGE cell where the work is. So for Problem 1, the first line of the cell should be `#Problem 1`.

Review

2. If you want all the integers from x to y you can use the shorthand notation $[x..y]$. Evaluate `[3..7]`.

3. If you want a list with m n's you can use the shorthand notation $[n] * m$. Evaluate `[0]*7`.

4. You can have a list of lists. Evaluate `L=[[0,1],[2,3],[4,5]]`. Now evaluate `L[1]`. Then evaluate `L[1][0]`. What do you think the value of `L[0][1]` is?

5. You can use *list comprehension* to get a list of the values of any function applied to an initial list. Evaluate `[x**2 for x in [2,5,9]]`.

6. List comprehension can also be used to *filter* the numbers in a list. Evaluate `[x for x in [2,5,9] if x%2==0]`. What did this do?

7. Evaluate `[x for x in [2,5,9] if x%2==1]`. What did this do?

More Calculus in Sage

8. Find the 3^{rd} derivatives for x^x by hand and then by using the `diff` command.

9. Find $\int 3x\,dx$ by hand. Check with `integral(3*x,x)`.

10. Let f(x)=3x. Let fint=integral(3*x,x). Check that diff(fint,x)=f(x).

11. Find $\int_1^2 f(x)\,dx$ by hand. Check using `integral(f(x),x,1,2)`.

12. Sketch $g(t) = t^{20}e^t$ on $(0, 3)$.

13. Find $\int t^{20}e^t\,dt$.

14. Find $\int_2^3 t^{20}e^t\,dt$.

15. Find a numerical approximation for $\int_2^3 t^{20}e^t\,dt$.

16. Try `numerical_integral(`$t^{20}e^t$`, 2, 3)`.

17. Find out what the second number of your answer means.

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.

18. Let `t=(2,3)`. Then evaluate t, and evaluate `type(t)`.

19. You can find the entries in a tuple just like you can with a list. Try $t[0]$, $t[1]$ and $t[2]$.

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

Matrices

21. 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])`. Then use `A.rref()` to find a matrix that represents an equivalent system in *row-reduced echelon form*.

22. 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.

23. 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.

24. 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)`.

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 - c06 worksheet attached" (so that it will be properly recorded).

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