

LARSON—MATH 255—CLASSROOM WORKSHEET 07
Matrices, Programming, Challenges

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 **c07**.
 - (f) 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**.

Review

2. Find a numerical approximation for $\int_2^3 t^{20} e^t dt$.
3. Try `numerical_integral(t20et, 2, 3)`.
4. Find out what the second number of your answer means.
5. 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*.
6. Now let `b=vector([5,6])`. Solve the matrix equation $A\hat{x} = \hat{b}$ using `A.solve_right(b)`.

New

7. Let `L=[1..50]`. Now use `is_prime` and list comprehension to filter the primes from list `L`.
8. 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.
9. 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)`.

10. 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.

Programming

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

11. Evaluate and test the following function. What do you think this function will do?

```
def for_loop_test():
    for i in [0..5]:
        print(i^2)
```

12. Modify your code to print the squares of the integers from 5 to 9. How did you change it?

13. Modify the code to print just the squares of 2, 5, 7, 9, and 23. How did you change it?

14. The function `list_evens(n)` that *returns* a list of 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
```

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

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

17. Write a function `count_prime_list(L)` that **returns a count** of all the primes in an input list L . Test it.

Challenges

18. **First Challenge.** You won't learn just by typing in code examples. It helps. Put you've got to solve stuff—if you are to develop real skills you can use in your other classes.

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder. What is the smallest positive number that is evenly divisible by all of the numbers from 1 to 20.

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