Last name _____

First name _____

LARSON—MATH 310–CLASSROOM WORKSHEET 18
The Mat Class.

Set up your CoCalc JUPYTER notebook for today's work.

1. Start the Chrome browser.
2. Go to `https://cocalc.com`
3. Log in.
4. You should see an existing Project for our class. Click on that.
5. Make sure you are in your Home directory (if you work in your Handouts directory, your work could get overwritten).
6. Click "New", then "Jupyter Notebook", then call it **310-c18**.
7. Make sure you have PYTHON as the *kernel*.

Review

1. What is the *transpose* of a matrix?
2. (**Quiz 4.4.2**) Write the procedure `transpose(M)` that, given an instance of `Mat` representing a matrix, returns the representation of the *transpose* of that matrix.
3. What is matrix-vector multiplication?
4. What is vector-matrix multiplication?

From: Chapter 4 of Klein's *Coding the Matrix* text

1. Go to your Handouts folder and copy the file `Mat_c18.py` to your Home directory (and `Vec_c15.py` too - if you were in class it will already be there - it hasn't changed). That has the fully-defined Mat (for *Mat*rix) class.

2. Run/evaluate to import everything from that file to memory.

```
from Mat_c18 import *
```

   That also imports the `Vec_c15` definitions.

3. Look at the `Mat_c18.py` file. You'll see that most of the code imitates the Vec code - except with the important difference that a Mat intance requires a *pair* (R, C) as input (where R and C are finite collections (the domain D of a Mat object is a collection of pairs).

4. Let's make a matrix instance:

```
M=Mat(({'a','b'}, {'@', '#', '?'}), {('a','@'):1, ('a','#'):2, ('a','?')
    :3, ('b','@'):10, ('b','#'):20, ('b','?'):30})
```

5. Check the domain of M: run `M.D`.

6. Check the function that defines M: run `M.f`.

7. Evaluate M to see what output we get.

8. Now try to *print* M.

9. Give the transpose of M the name MT and then print it.

10. Can we add matrices together?

11. Can we multiple a scalar times a matrix?

12. Is there a zero matrix?

13. What do you think might be true about the collection of matrices with the same domain, and function values from the same field?

Matrix Multiplications

14. Code a matrix and a vector so that this matrix-vector product is defined. Then test.

Example 4.5.2: Let's consider a

$$\begin{bmatrix} 1 & 2 & 3 \\ 10 & 20 & 30 \end{bmatrix} * [7, 0, 4]$$

15. Code, a matrix and a vector so that this vector-matrix product is defined. Then test.

Example 4.5.7:

$$[3, 4] * \begin{bmatrix} 1 & 2 & 3 \\ 10 & 20 & 30 \end{bmatrix}$$

Getting your classwork recorded
When you are done, before you leave class...

1. Click the "Print" menu choice (under "File") and make a pdf of this worksheet (html is OK too).

2. Send me an email (`clarson@vcu.edu`) with an informative header like "Math 310 - c18 worksheet attached" (so that it will be properly recorded).

3. Remember to attach today's classroom worksheet!