**Last name** _____

**First name** _____

**LARSON—MATH 310–CLASSROOM WORKSHEET 06**
**The Vec Class.**

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

   (a) Start the Chrome browser.

   (b) Go to `https://cocalc.com`

   (c) Log in.

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

   (e) Make sure you are in your Home directory (if you work in your Handouts directory, your work could get overwritten).

   (f) Click "New", then "Jupyter Notebook", then call it **310-c06**.

   (g) Make sure you have PYTHON as the *kernel*.

   **Review**

   (a) What is `range` in PYTHON?

   (b) What is `zip` in PYTHON?

   (c) What is a *dictionary* in PYTHON?

   (d) What are the *keys* of dictionary $D$? What are the *values*? How do you find the value associated to a given key?

   (e) How can you check if there is an entry in dictionary $D$ for a particular key?

   (f) How can you add a new key-value pair to a dictionary (say *key:value* to $D$)?

   (g) How do you import the procedure `randint` from the module `random`?

   (h) How do you define a complex number $z = 3 + 4j$ using the `complex` constructor?

   (i) Recover the real part of $z$ with the `.real` attribute

   (j) Recover the real part of $z$ with the `.imag` attribute. Code and run.

   (k) Find the (complex) conjugate of $z$ with the `.conjugate` method.

   (l) Find the absolute value (or length of the $Z$ arrow in the complex plane) of $z$ using `abs`.

   (m) Find the multiplicative inverse of $z$ as a reciprocal.

2. In Python, assign to the variable $L$ a list of 2-element lists as follows. Code and run.

```
L = [[2, 2], [3, 2], [1.75, 1], [2, 1], [2.25, 1], [2.5, 1], [2.75,
1], [3, 1], [3.25, 1]]
```

3. For 2-vectors represented in Python as 2-element lists, the addition procedure is as follows. Code and run.

```
def add2(v,w):
    return [v[0]+w[0], v[1]+w[1]]
```

4. (**Quiz 2.4.4**) Suppose we represent $n$-vectors by $n$-element lists. Write a procedure `addn` to compute the sum of two vectors so represented.

5. (**Quiz 2.5.3**) Suppose we represent $n$-vectors by $n$-element lists. Write a procedure `scalar_vector_mult(alpha, v)` that multiplies the vector $\hat{v}$ by the scalar $\alpha$.

6. (**Scalar-vector multiplication distributes over vector addition**): $\alpha(\hat{u} + \hat{v}) = \alpha\hat{u} + \alpha\hat{v}$
Example 2.6.4: As an example, consider the multiplication:

```
2 ([1, 2, 3] + [3, 4, 4]) = 2 [4, 6, 7] = [8, 12, 14]
```

7. What is a *convex combination*?

8. (**Task 2.6.9**) Write a python procedure `segment(pt1, pt2)` that, given points represented as 2-element lists, returns a list of a hundred points spaced evenly along the line segment whose endpoints are the two points.

9. Plot the hundred points resulting when pt1 = [3.5, 3] and pt2 = [0.5, 1].

```
class Vec:
    def __init__(self, labels, function):
        self.D = labels
        self.f = function

```

10. Once Python has processed this definition, you can create an instance of Vec as follows. Code and run.

```
Vec({'A','B','C'}, {'A':1})
```

11. (**Quiz 2.7.1**) Write a procedure `zero_vec(D)` with the following spec:
• input: a set D
• output: an instance of Vec representing a D-vector all of whose entries have value zero.

12. Look in the Handouts folder for the *vec.py* file and the *class* definition of the vector class `Vec`.

**Getting your classwork recorded**

When you are done, before you leave class...

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

(b) Send me an email (`clarson@vcu.edu`) with an informative header like "Math 310 - c06 worksheet attached" (so that it will be properly recorded).

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