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 s03, 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.
   
   (f) When you are finished with the worksheet, click “make pdf”, email me the pdf (at clarson@vcu.edu, with a header that says Math 356 s03 worksheet attached).

Control

It is often useful to manipulate and/or create tuples.

2. Here is a function that takes 2 numbers as inputs and returns a tuple (pair) with twice numbers.

   ```python
def tuple_test(x,y):
   t=(2*x,2*y)
   return t
```

   Evaluate. Let s=tuple_test(3,4). Evaluate.

3. Now write a function pair_square(x,y) that takes any numbers x and y and returns a tuple (pair) that is the squares of these numbers.

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

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

   ```python
def for_loop_test():
   for i in [0..5]:
       print i^2
```
5. Modify your code to print the squares of the integers from 5 to 9. How did you change it?

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

7. The function `list_evens(n)` that returns all the even integers from 0 to \( n \). Evaluate and test the following code.

   ```python
   def list_evens(n):
       M=[]
       for x in [0..n]:
           if x%2==0:
               M.append(x)
       return M
   ```

8. Write a function `list_primes(n)` that returns a list of all the primes up to \( n \). Use Sage's built-in `is_prime(n)` function. Test it.

   ```python
   A while loop runs a block of code while a condition is still satisfied.
   
   9. Type in and evaluate the function `while_test()`. What do you think this function will do?

   ```python
   def while_test():
       i=0
       while i<5:
           print i^2
           i=i+1
   ```
10. A common way to use a while loop is in a test where you don’t know precisely when the test condition will be met. Here we will write a function that prints the first $n$ primes. We will use a \textit{counter} to keep track of how many we have so far. The first version works and the 2\textsuperscript{nd} runs forever. Why?

\begin{verbatim}
def print_first_n_primes2(n):
    count = 0
    current_number = 0
    while count < n:
        if is_prime(current_number) == True:
            print current_number
            count = count + 1
        current_number = current_number + 1

def print_first_n_primes(n):
    count = 0
    current_number = 0
    while count < n:
        if is_prime(current_number) == True:
            print current_number
            count = count + 1
        current_number = current_number + 1
\end{verbatim}

\textbf{Built-In Graph Classes in Sage, Adjacency and Incidence Matrices}

11. How can we get the following graph into Sage/Cocalc?

12. Use Sage to find an incidence matrix for this graph.

13. Use Sage to find an adjacency matrix for this graph.