

Last name _____

First name _____

LARSON—MATH 356—SAGE WORKSHEET 16
Eulerian & Hamiltonian Cycles

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 **s16**, 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 s16 worksheet attached**).

Saving and Re-using Code

We’ve coded several graphs now, and have added code for functions of graph invariants and auxiliary functions and stored them in “graphs.sage”. I pushed my updated version to your Handouts folder. Either copy that file to your Home directory—or add the new stuff to your own “graphs.sage” file. We’ll need those functions.

2. I’ve updated the copy of “graphs.sage” in your Handouts folder to include what we’ve added in class. *Copy* the current version from Handouts to your Home directory.
3. *Load* your copy of “graphs.sage”. Run: `load('graphs.sage')`.
4. Run: `my_graphs` to see what graphs we have so far. (This is partly a test to make sure your file is loaded.)

Concepts from Our Text

These include: *size, order, complete graphs, bipartite-ness, isomorphic graphs, sub-graph, complement, incidence matrix, adjacency matrix, degrees, minimum degree, maximum degree, identical graphs, connectedness, number of components, tree-ness, distances*. **These are all built-in to Sage/Cocalc!**

5. Write a function that tests if a graph has an Eulerian cycle.
6. Write a function that *finds* an Eulerian cycle if one exists.
7. Write a function that *finds* an Eulerian trail if one exists.
8. Write a function that *finds* a Hamiltonian cycle if one exists.