Last name _____

First name _____

LARSON—MATH 356—LAB WORKSHEET 05
Dijkstra's Algorithm!

Reminders

1. Remember to email your Notes/Classroom Worksheet prior to the next class.

2. Homework $h03$ is due next Tuesday: #1.5.1, 1.5.3, 1.6.1.

3. Homework $h04$ will be a Test Review.

4. Test 1 is Tuesday, Mar. 23.

5. Read ahead in our textbook. We're into Chp. 2 and trees!

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 **s05**, 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 s05 worksheet attached**).

   Testing if a (Connected) Graph is Bipartite

2. Write a function `is_bipartite(G)` that takes a connected graph G as input and returns TRUE is G is bipartite and FALSE if it is not bipartite.

   Saving and Re-using Code

3. Any code you want to re-use can be saved in a `.sage` file (a text file with a name that just helps you remember what's in the file) and can be *loaded* into memory at any time. There is a "graphs.sage" file in your Cocalc project Handouts—copy that into your "home" directory (to make it yours—then you can change it—the copy in the Handouts folder will change as I change it).

4. Go to your files list, click on "graphs.sage" to see what that file looks like. Add your own comment to this file (like "#I can add my own graphs here!").

5. Now *load* that file. Run: `load('graphs.sage')`.

6. Run: `my_graphs` to see what we have so far.

   Concepts from Our Text

   These include: *size, order, complete graphs, bipartite graphs, isomorphic graphs, subgraph, complement, incidence matrix, adjacency matrix, degrees, minimum degree, maximum degree, identical graphs.*

   These are all built-in to Sage/Cocalc!

7. How can we test is a graph is complete in Sage?

8. How can we test is a graph is bipartite in Sage?

9. How can we test if two graphs are isomorphic in Sage?

10. How can we find the complement of a graph in Sage?

11. How can we produce an induced subgraph with a particular subset $V' \subseteq V$?

12. How can we find the vertices of a given graph G?

13. How can we find the edges of a given graph G?

14. How can we test if two graphs are identical?

15. How can we find the degrees of a graph?

16. How can we find the maximum degree?

17. How can we find the minimum degree?

   Implement Dijkstra's algorithm

18. We need a function `dijkstra(G,v)` that takes a weighted graph G and vertex v as inputs and outputs the length of a shortest (weighted) path from v to each other vertex.