

# MCL summer workshop in graph theory

## Project descriptions

Due: Thursday, July 14, 2016

You will spend the rest of your labs working in pairs on one of the following projects below. You can choose your partners and projects or I can assign them. On the last day of class you will present your work.

### Project 1: Maze solver

In class I mentioned that you can use breadth-first search to solve mazes. In this project you will write a program which does so. First you will construct a graph from a text representation of a maze. Then you will use BFS to solve the maze. Finally, you will print a pretty picture of the solution.

Full project: <http://homepages.math.uic.edu/~scole3/summer2016/project1.zip>

### Project 2: Weighted graphs and Google Maps

A *weighted graph* is a graph  $G$  in which each edge  $e$  has a nonnegative weight  $w(e)$ . The *shortest path* between two vertices  $u$  and  $v$  in  $G$  is defined as the path from  $u$  to  $v$  with minimum total weight (i.e., the sum of the weights of the edges in the path). The *distance* from  $u$  to  $v$  is the sum of the weights of the edges in this path.

In this project you will try to come up with an algorithm for finding shortest paths in a weighted graph similar to breadth-first search in an unweighted graph, and you will relate this problem to the problem of finding the fastest route from one city to another in Google Maps.

Full project: <http://homepages.math.uic.edu/~scole3/summer2016/project2.zip>

## Presentations

On the last day of class (Thursday, July 14) you will give a short presentation of your project for Sam, Ben, and your classmates. During your presentation you should

- Introduce your problem in formal mathematical language.
- Give a demo of your code and describe how it works.

You don't have to make a PowerPoint or anything, but you should use the board to write down definitions, give examples, etc.

## What to turn in

Your project will be contained in an iPython notebook. You can save your work directly in the notebook (Ctrl-s). **When you are done, please email your notebook to scole3@uic.edu by Thursday, July 14.**

Don't worry if you're not able to finish your project! You can turn in whatever portion you are able to complete. Conversely, if you finish early I have plenty of other stuff for you to work on!