Scientific Computing | Fitchburg State University, Department of Mathematics, Project #1 | November 2, 2016

The following problems should be done in julia. Type up the code you used to find your results and answer all questions. Submit your homework via Blackboard by uploading the ipynb file. This assignment should be submitted no later than 11:59pm on October 19, 2016.

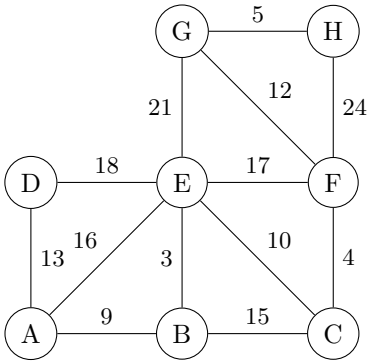
1. This problem solves a real-world Traveling Salesperson Problem (TSP) using distance data. We will find the shortest total path between the Massachusetts cities/towns: Boston, Fall River, Fitchburg, Lowell, North Adams, Springfield and Worcester. Follow these steps to do this:

   (a) Use the brute force algorithm that goes through each path to determine the shortest total distance. Find the distance and write down the path as it goes through each town. Start and end with Fitchburg and write down the town names of the shortest path. (Hint: it is highly recommended to sign up for

   (b) Add the following towns: Amherst, Braintree, Lawrence, Newton, Natick, Pittsfield, Plymouth, Provincetown, Salem, Woburn to the list above. Produce an array of distances in alphabetical order.

   (c) Use a Simulated Annealing algorithm to find a minimum path through all of the town in (a) and (c). Use as large a number of randomizations in your algorithm as possible. Find the total distance as well as the path of the towns. Start and end with Fitchburg and write down the town names of the shortest path.

2. Consider the following weighted graph:



   Use the method from class using tropical arithmetic on matrices to find the shortest path from A to H.

3. Use the Dijkstra's Algorithm to find the shortest path from A to H for the graph in the previous problem.

4. This problem finds the shortest distance from Fitchburg State to the Entertainment Cinemas in Leominster which mimics Google Maps or another mapping/GPS program.

   (a) Create a graph that has Fitchburg State as the starting point (use 160 Pearl St.) and the Entertainment Cinemas (45 Sack Blvd, Leominster, MA 01453) as the end. Include the following intersections in your graph:

   - North Street and Main Street (Fitchburg)
   - John Fitch Hwy and Lunenburg Street (Fitchburg)
   - South Street and Laurel Street (Fitchburg)
   - South Street and Wanoosnoc Rd (Fitchburg)
   - Water Street and Bemis Rd (Fitchburg)
   - Summer Street and John Fitch Hwy (Fitchburg)
   - North Street and Main Street (Lunenburg)

- Main Street and Prospect Street (Lunenburg)
- N. Main Street and Rte 2 (Lunenburg)
- Merriam Ave and Rte 2 (Lunenburg)
- Haws Street and Commercial Road (Lunenburg)

Note: you don't need to provide edges between all of these nodes, but reasonable ones.

(b) Use the Tropical Matrix Arithmetic method to solve this problem. List the path travelled that minimizes the travel distance and the nodes (intersections) travelled through.

(c) Use Dijkstra's method to solve the problem. List the path travelled that minimizes the travel distance and the nodes (intersections) travelled through.