ENGS 104 Assignment 3

Fall 2015

Professor George Cybenko

- Due Tuesday, November 17

Problem 1

- Write a Matlab function that takes as single input the node adjacency matrix of a multigraph, G, and computes the values 0 or 1 according to whether G is not an Eulerian Graph (is connected and each node has even degree) or is an Eulerian Graph.

- G is an n by n matrix with non-negative integer entries with the interpretation that G(i,j) = k means there are k undirected edges between i and j.

- The function is to be named Eulerian and called as Eulerian(G).

Problem 2

- For a multigraph, G, and a candidate Eulerian path, P, write a Matlab function that determines whether P is an Eulerian path in G. That is, it traverses every edge in G and has the same start and end node.
- G is represented as in Problem 1 and P is represented as a vector of successive nodes visited, so that P=[a b c ... i j ... r a] means the nodes are visited in the order a,b,c,etc. according to the proposed path P.
- Name the function, isapath and call it as isapath(G,P). It returns 0 if the path is not Eulerian for G and 1 if it is.

Problem 3

- Write a Matlab function that attempts to compute an Eulerian path for a multigraph, G
- Call the function epath and call it as epath(G)
- The value returned by epath(G) is 0 if there is no Eulerian path and a vector P which is an Eulerian path if G is Eulerian where P describes an Eulerian path as in Problem 2.

Problem 4

- A weighted undirected graph is represented as a matrix H where H(i,j) represents the weight of the undirected edge between i and j. You can assume the graph is connected.
- Write a Matlab function that computes a minimal spanning tree for H.
- Name the function MST and call it as [M,w]=MST(H) with returned value [M,w] where the matrix M is defined as M(i,j) = 1 if the edge i,j is in the minimal spanning tree and M(i,j) = 0 if i,j is not in the spanning tree and w is the weight of the minimal spanning tree (namely the sum of the weights in the minimal spanning tree).

Problem 5

- Write a Matlab function that computes a 1-approximate solution for the Euclidean Travelling Salesman Problem on a weighted, undirected, completely connected graph, T, by:
  - computing the minimal spanning tree of T, say S;
  - making an Eulerian graph, R, from S by doubling the edges;
  - computing an Eulerian path in R, say P;
  - constructing an approximating tour in T from the Eulerian path P.

- Name this function TSP1 and call it as x=TSP1(T) where x is a vector listing the nodes visited in order.

Problem 6

- For an instance of the Euclidean TSP, say T, compute or approximate a solution using integer linear programming or any other technique you have available such as simulated annealing, genetic algorithm, etc.
- Call the function as x=TSPa(T) where x is a vector listing the nodes visited in order

Problem 7

- Load the sample Euclidean TSP problem T.mat and compute both the 1-approximate solution you obtained in Problem 5 and the other approximate solution you obtained in Problem 6.
- Compare the results
- Prizes for the best solutions!!!