Lab 9 – Graph Problems (1)

9.1 Graph Reading

Consider the undirected weighted graphs specified in the zip file graphs.zip, with the following format

```
nn  aa
ni  nj wij *
```

where the first line indicaes the number **`nn`** of nodes and the number **`aa`** of arcs, and the subsequent aa lines specify the arcs, each with a triple **`<ni,nj,dij>`** where **`ni`** and **`nj`** are the node identifiers and **`wij`** the weight of the connecting arc. Note that the graphs are (implicitly) symmetric, and so for any arc between nodes i and j there is an arc between nodes j and i with the same weight.

Specify a function with signature **`function M = read_graph(filename)`** that reads a graph with the above format from a file with name filename, and returns the adjacency matrix M of the represented graph.

9.2 Minimum Spanning Trees

a) For the graphs read from the file, check whether they are connected.
b) For those that are connected, find the minimum spanning tree, using Prim's algorithm that you should implement with signature **`function T = prim(M)`** , where **`M`** is the adjacency matrix of the graph, and **`T`** the minimum spanning tree.
c) Specify a function with signature **`function print_graph(M,filename)`** that, for a graph given by its adjacency matrix **`M`**, writes it a file with name filename, with the same format as above.

9.3 Shortest Distance

a) Specify a function with signature **`function D = floyd(M)`** that, for a graph given by its adjacency matrix **`M`**, where the weights are considered distances, returns matrix D with the minimum distances between any nodes i and j, (e.g. obtained with the Floyd-Warshall algorithm).
b) Given a matrix D of minimal distances between any two node in a graph, specify a function with signature **`function [imax,jmax,dmax] = farthest(D)`** that returns the two nodes **`imax,jmax`**, whose minimum distance between them, **`dmax,`** is maximal.