National University
of computer and emerging sciences

ALGORITHMS PROJECT Report

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Sec: 5G

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Abstract:

We have introduced a system that can accommodate between 10 to 100 nodes for all said graph algorithms as follows:

(1) Prims

(2) Kruskal

(3) Dijkstra

(4) Bellman Ford

(5) Floyd Warshall Algorithm

(6) Clustering Coefficient in Graph Theory (Only Local Clustering). The final cost should be the average of all local clustering of all nodes

(7) Borůvka's algorithm

For an inputted adjacency matrix, a corresponding graph is returned.

Introduction:

Kruskal's algorithm finds a minimum spanning forest of an undirected edge-weighted graph. If the graph is connected, it finds a minimum spanning tree. (A minimum spanning tree of a connected graph is a subset of the edges that forms a tree that includes every vertex, where the sum of the weights of all the edges in the tree is minimized. For a disconnected graph, a minimum spanning forest is

composed of a minimum spanning tree for each connected component.) It is a greedy algorithm in graph theory as in each step it adds the next lowest-weight edge that will not form a cycle to the minimum spanning forest.

Dijkstra:

Dijkstra's algorithm is very similar to Prim's algorithm for minimum spanning tree. Like Prim's MST, we generate a SPT (shortest path tree) with a given source as a root. We maintain two sets, one set contains vertices included in the shortest-path tree, and other set includes vertices not yet included in the shortest-path tree. At every step of the algorithm, we find a vertex that is in the other set (set of not yet included) and has a minimum distance from the source.

Bellman–Ford:

The Bellman–Ford algorithm is an algorithm that computes shortest paths from a single source vertex to all of the other vertices in a weighted digraph. It is slower than Dijkstra's algorithm for the same problem, but more versatile, as it is capable of handling graphs in which some of the edge weights are negative numbers.

Floyd–Warshall:

Floyd–Warshall algorithm (also known as Floyd's algorithm, the Roy–Warshall algorithm, the Roy–Floyd algorithm, or the WFI algorithm) is an algorithm for finding shortest paths in a directed weighted graph with positive or negative edge weights (but with no negative cycles). A single execution of the algorithm will find the lengths (summed weights) of shortest paths between all pairs of vertices.

Clustering coefficient:

In graph theory, a clustering coefficient is a measure of the degree to which nodes in a graph tend to cluster together. Evidence suggests that in most real-world networks, and in particular social networks, nodes tend to create tightly knit groups characterized by a relatively high density of ties; this likelihood tends to be greater than the average probability of a tie randomly established between two nodes

Borůvka's Algorithm:

Borůvka's algorithm is a greedy algorithm for finding a spanning tree in a graph. The algorithm begins by finding the weight edge incident to each vertex of the graph, and adding all of those edges to the forest. Then, it repeats a similar process of finding the minimum-weight edge from each tree constructed so far to a different tree, and adding all of those edges to the forest. Each repetition of this process reduces the number of trees, within each connected component of the graph, to at most half of this former value, so after logarithmically many repetitions the process finishes. When it does, the set of edges it has added forms the spanning forest.

Proposed system:

It is proposed that there should exist an application software, which can be utilized in on industry level for all kinds of use cases. Some popular areas where system would be needful are: Navigational Maps, Mobile Network Coverage, routes for train junctions or airport flights etc.

Experimental Setup:

Our experimental setup includes a Python-run system where using the aid from Tkinter & NetworkX Library, we are achieving well-visualized graphical representation of the required algorithms.

Results and Discussion (Results from benchmarks):

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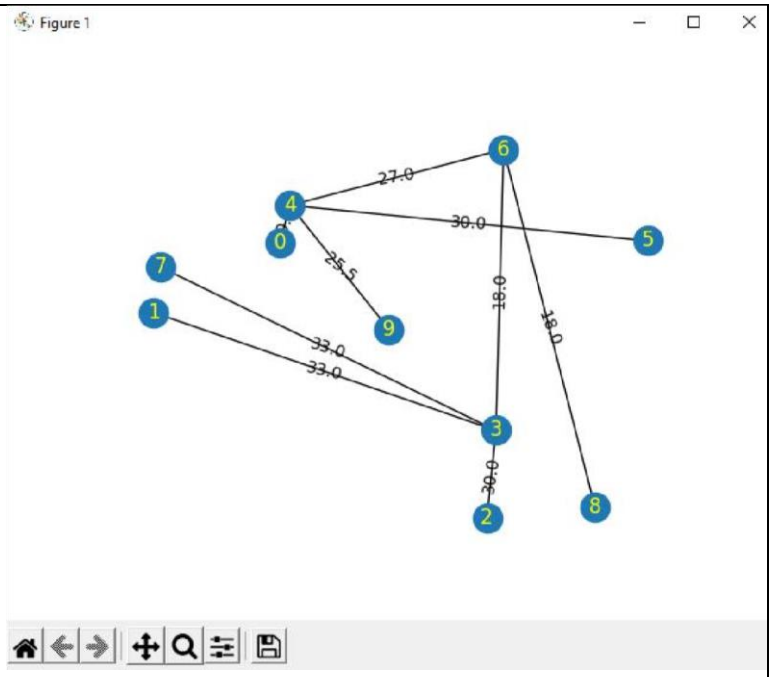
<td> 
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<tr>
<td>Starting windows where user can select algorithm and input file from drop down.</td>
<td>Prims algorithm output</td>
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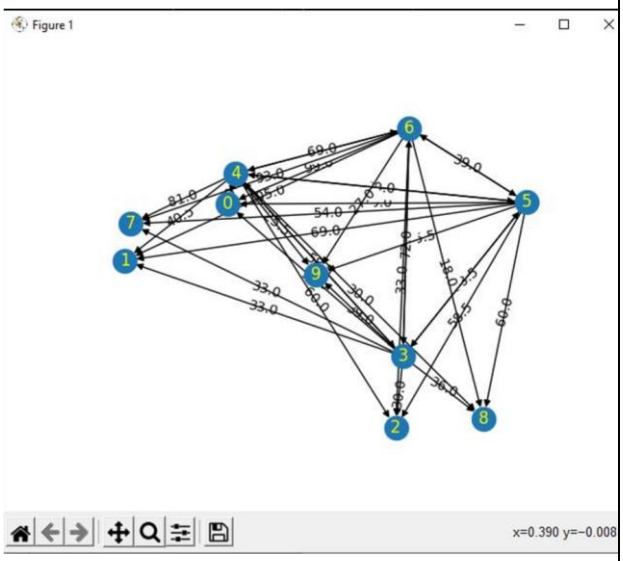
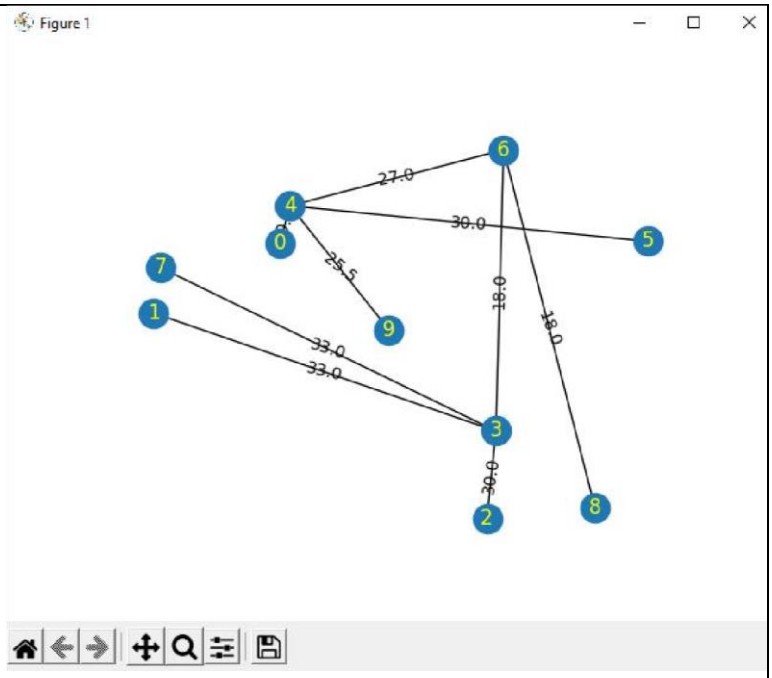
</table>



Floyd warshal algorithm output



Kruskal algorithm output

Conclusion:

We have succeeded in depicting the behavior of the graphs as per the algorithms provided.

References:

- Geeksforgeeks
- Course Textbook