EE1103: Numerical Methods

Programming Assignment # 10

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1 Problem 1

We are required to find the shortest path from a selected source node to other nodes in a bi-directed graph.

1.1 Approach

We employ Dijkstra's algorithm here. This is a technique of solving for the shortest path from a source node to all other nodes simultaneously.

1.2 Algorithm

```
1   for n:1 to total number of nodes
2       for i:n to total nodes
3           pivot node=k;cost[k]=min(cost[i])
4       swap pivot node and n
5       for j:n to total nodes
6           cost[j]=min(cost[j],cost[pivot node+D(pivot node,j)
```

1.3 Results

These are the results from executing the code.
assuming that 1 is the source node,we get:
the length of the shortest path between the source node and node 1 is 0.000000
the length of the shortest path between the source node and node 4 is 1.000000
the length of the shortest path between the source node and node 2 is 3.000000
the length of the shortest path between the source node and node 6 is 5.000000
the length of the shortest path between the source node and node 3 is 6.000000
the length of the shortest path between the source node and node 5 is 11.000000

1.4 Inferences

While parsing through the cost array, there are a couple of ways of identifying whether the shortest path to the node has been found out or not. Flags or boolean arrays can be used. Otherwise, like what i have implemented, the pivot nodes can be bubbled to the left of the array. This can be further useful if the actual path corresponding to the shortest distance is required.

1.5 Contributions

I worked on this assignment independently.

2 Problem 2

We are required to find the shortest path from a selected source node to other nodes, this time in a directed graph.

2.1 Approach

We employ Dijkstra's algorithm here as well.

2.2 Algorithm

```
1   for n:1 to total number of nodes
2       for i:n to total nodes
3           pivot node=k;cost[k]=min(cost[i])
4       swap pivot node and n
5       for j:n to total nodes
6           cost[j]=min(cost[j],cost[pivot node+D(pivot node,j)
```

2.3 Results

These are the results from executing the code.
assuming that 4 is the source node,we get:
the length of the shortest path between the source node and node 4 is 0.000000
the length of the shortest path between the source node and node 2 is 2.300000
the length of the shortest path between the source node and node 3 is 3.400000
the length of the shortest path between the source node and node 5 is 6.400000
the length of the shortest path between the source node and node 1 is inf
the length of the shortest path between the source node and node 6 is inf

2.4 Inferences

The graph information is captured in an adjacency matrix. This time however, since the graph is directed, some nodes cannot be reached at all. Also D(u,v) is not equal to D(v,u).(they would be equal in a non-directed graph)

2.5 Contributions

I worked on this assignment independently.