IC250 Lab 8

1. A rail network is to be created between the following cities: Kanyakumari (KK), Chennai (CHN), Bangalore (BLR), Mangalore (MGL), Hyderabad (HYD), Mumbai (MUM), Kolkata (KOL), Delhi (DEL) and Mandi(MAN). The cost of the rail link, in hundreds of crores of rupees, is given below:

KK-CHN	5
CHN-BLR	4
BLR-MGL	4
KK-MGL	8
MGL-MUM	9
CHN-KOL	10
CHN-HYD	5
HYD-MUM	4
HYD-DEL	6
MUM-DEL	5
DEL-MAN	15
KOL-DEL	6

   The objective is to have a rail connection from any two cities (passing through intermediate cities if necessary), with minimum construction cost. Model this as a graph problem and find the network as desired.

   File input format: The file representing the above weighted graph has the following format. You may map each city name to a corresponding vertex number.

```
5 6 2 # Num vertices, num edges. Vertices are labeled 1 to N.
1 2 4 # Each edge appears once, with the starting vertex, ending vertex and weight.
2 3 4
3 4 7
4 5 15
5 1 45
2 4 3
```

2. Given the rail network represented by the above links, find the minimum distance between a starting station and all other stations. Use Dijkstra's shortest path algorithm. **Note**: Do not use the minimum spanning tree as the network; the rail network is specified by the input graph.
   Input: A network specified in the format above, and a start station.
   Output: A minimum distance from the start station to all other stations.

3. **Optional.** Modify Dijkstra's algorithm to work when both edges *and* vertices have weights. The cost of a path from x to y is the sum of the weights of all edges and vertices on the path. For this you will not need to modify the algorithm itself, you need to do some preprocessing so that the graph is correctly represented. Also extend the input file representation of the graph so as to include edge weights as well as vertex weights. *(3 marks)*