Birla Institute of Technology & Science, Pilani
Data Structures & Algorithms (CS F211)
Lab Assignment – 12 (Dijkstra's single source shortest path algorithm)

Instructions:

- All input expressions should be read from stdin and output should be printed on stdout.
- For 1 hour 45 min, only a subset of test cases will be visible to students after submitting the code on the portal. After 1hour 45 min, all test cases will be made visible and they will have last 15 min to correct their code and resubmit.
- At the end of 2 hour period, the online system will stop accepting the submissions.
- Only the last submission by the student before end of lab will be considered for evaluation.
- Following messages by online portal will **tentatively** fetch these marks:
  - Correct and implemented using Heap as a Priority Queue ➔ 4 marks
  - Wrong-answer (correct for more than half test cases) or implemented without using Heap as a Priority Queue. ➔ 3 marks
  - Run-error/Compiler-error (provided you have written some code related to problem) ➔ 2 marks
- All submitted source code will be later checked manually by the instructor and final marks will be awarded, which will be posted on Nalanda after the lab assignment has been done by all lab sections.
- Solution must be implemented using the algorithm and data structures mentioned in the lab sheet only.

Problem

Implementation of Dijkstra's single source shortest path algorithm.

Input Format:

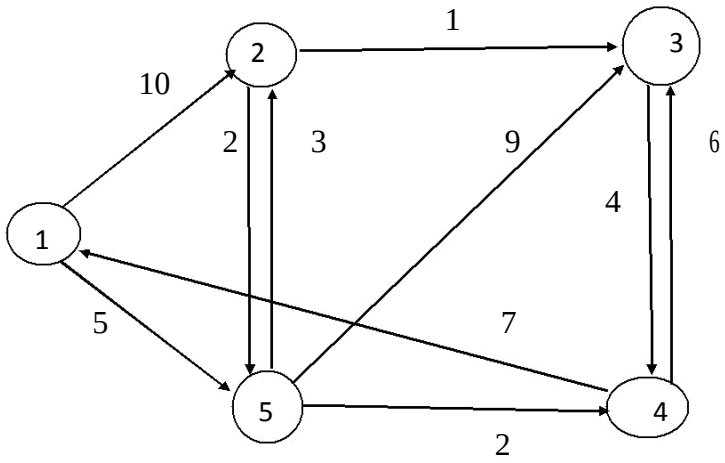
You will be given adjacency list representation of a weighted directed graph together with a source vertex. Vertices will be numbered starting from 1 in sequential order:1,2,3,4…….

First line of input will specify the number of vertices in the graph.

Second line of input will specify the source vertex.

From third line onwards adjacency list representation of the weighted directed graph will be given in sorted order of vertices. Each row will specify the adjacent vertices together with edge weights in sorted order in the following format:

1 Number of the adjacent vertex adjacent vertex1 weight of the edge from 1 to adjacent vertex1….



Example Graph G1

Output Format:

Each line have the pair

Vertex number Shortest path weight from source to this vertex

In sorted order of vertex.

Note:

If there is no path from source vertex to any vertex in the graph then print 99999.

For lectures use this link 172.50.20.36/dsaslides.zip

Sample Input:

```
5
1
1 2 2 10 5 5
2 2 3 1 5 2
3 1 4 4
4 2 1 7 3 6
5 3 2 3 3 9 4 2
```

Sample Output:

```
1 0
2 8
3 9
4 7
5 5
```

Procedure

Please refer “Shortest Paths in a graph” in “Greedy algorithms tutorial” on Nalanda. You will have to use Heap as a priority Queue so that the algorithm has complexity O(|E|log(|V|)).