July 2023 CSE 208: Data Structures and Algorithms II Sessional Assignment on All Pairs Shortest Path Problem

Deadline: 18 December, 2023 11:55 PM

There are n cities in a country. The cities are labelled from 1 to n. Some of these cities are connected to each other via roads. You can think of the roads as bidirectional edges. Every road has a cost associated to them, depending on the distance between the cities connected by that road. You are also given a threshold cost. Your task is to determine the city with the smallest number of cities that are reachable from the first city with the cost being at most the threshold cost. Please refer to the sample I/O for a better understanding.

Input

The first line of the input file will contain the number of cities n ($0 < n \leq 100$) and the number of roads m ($0 < m \leq 10000$) followed by m lines each containing three space separated integers: city u, city v and the cost w ($0 < w \leq 100$). The final line contains one integer: the threshold cost.

Output

Print the city with the smallest number of cities that are reachable from the first city with the cost being at most the threshold cost. If there are multiple such cities, you need to print all of them.

Sample I/O

Case 1

Input

```
4 4
1 2 3
2 3 1
2 4 4
3 4 1
4
```

Output

```
1 4
```

Explanation

From *city 1*, we can reach *city 2* with cost 3, *city 3* with cost 4, *city 4* with cost 5. Here, only *city 2* and *city 3* satisfy the threshold cost 4 (we can reach *city 2* and *city 3* from *city 1* with cost being at most the threshold cost). So, from *city 1* we can reach 2 cities without violating the constraint. In a similar manner, the city count for *city 2* is 3, for *city 3* it is 3 and for *city 4* it is 2. So the output is 1 and 4.

Case 2

Input

```
4 6
1 2 8
1 4 1
2 3 1
3 1 4
```

```
4 2 2
4 3 9
4
```

Output

```
1 2 3 4
```

Case 3

Input

```
4 6
1 2 8
1 4 1
2 3 1
3 1 4
4 2 2
4 3 9
3
```

Output

```
1 3
```

Case 4

Input

```
5 8
1 2 2
1 3 4
1 5 8
2 3 3
2 4 5
2 5 2
3 4 1
4 5 1
4
```

Output

```
1 4
```

Case 5

Input

```
5 6
1 2 2
1 5 8
2 3 3
2 5 2
3 4 1
4 5 1
2
```

Output

```
1
```

Hints

You need to determine the distance matrix for the given graph first.

Marks Distribution

- Properly taking input and forming a graph data structure: 5%
- Determining the distance matrix: 65%
- Printing the correct cities as output: 30%

Special Instructions

1. Please DO NOT COPY solutions from anywhere (your friends, seniors, internet etc.). Any form of plagiarism (irrespective of source or destination), will result in getting -100% marks in the online/offline.
2. Deadline: 18 December, 11:55 PM
3. Rename all the problem solutions according to your student ID. If your ID is 2105XXX, then create a folder named 2105XXX. Afterward, rename problem 1 as 2105XXX_problem1.cpp, and similarly, rename the others. Next, move all the solutions inside the folder. Create a zip file of that folder. Lastly, submit the zip file.