IOI Training Camp 2011 – Final 2, 22 June, 2011

Problem 3 Fake Passports [Standard]

Daku Singh is in trouble. He has just pulled off a daring international crime—in one night, he has erased the Facebook accounts of millions of unsuspecting users. There has been worldwide condemnation of this heinous deed. Governments of most countries are worried that unless they catch Daku Singh, their citizens will revolt. They have formed an alliance and are cooperating with Interpol to arrest him.

Daku Singh is currently in the prosperous country of Navalur. Daku Singh's only hope of avoiding capture is to escape to the obscure country of Siruseri, where he will be safe because everybody dislikes Facebook.

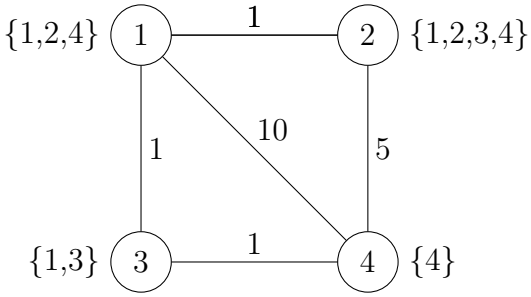
Not all pairs of countries are connected by direct flights. To travel from Navalur to Siruseri, he has to take, in general, a sequence of direct flights, forcing him to pass through intermediate countries. Each pair of countries connected by a direct flight has flights in both directions, both with the same flying time. Daku Singh knows how long each flight takes. His aim is to get from Navalur to Siruseri in the shortest possible time.

The main complication is that his passport has been confiscated by Interpol. Fortunately, he still has a lot of non-Facebook friends who can provide him with a fake passport in every country where he might have to travel. When he is in a country C, he can choose to buy a fake passport of type C, which will allow him to enter a certain subset S_C of other countries. This subset depends on the country where he obtains the passport and, of course, the current country C is always included in the subset S_C. Since he doesn't want to get caught with two passports, once he buys a new fake passport he has to throw away the one he currently holds.

Daku Singh *must* buy a fake passport at Navalur to start his journey. Also, whenever he lands in a country C holding a passport bought in country D, the country C must be in the set of countries S_D that his existing passport allows him to visit. He may visit a country more than once on his way to Siruseri.

Fake passports don't come cheap and Daku Singh can afford to buy at most K passports. Given this, your task is to help him find the shortest time he needs to travel from Navalur to Siruseri.

For instance, suppose there are four countries connected by direct flights as shown on the right. The countries are numbered $1, 2, 3, 4$, where 1 represents Navalur and 4 represents Siruseri. Each edge represents a direct flight and is labelled with the time the flight takes. Each node i is labelled by the set of countries S_i that you can visit if you buy a passport of type i.



In this example, one possible route is to go from 1 to 4 directly, buying a passport only at node 1. This route takes 10 time units. The route $1 \to 2 \to 4$, buying a passport only at 1, takes time 6. Another valid route is $1 \to 2 \to 1 \to 3 \to 4$, buying a passport at node 1 at the beginning of the journey and then at node 2. This route takes time 4. You can check that there is no shorter route. If, however, Daku Singh could afford to buy only 1 passport, the shortest possible route would take time 6.

Input format

The first line of input contains three integers N, M, and K, where N is the number of countries, M is the number of direct flights between pairs of countries and K is the number passports that Daku Singh can afford to buy. The countries are numbered $1, 2, \ldots, N$, where 1 represents Navalur and N represents Siruseri.

Lines 2 to M+1 describe the M direct flights. Each of these lines contains three integers of the form i j t, where $i \neq j$, indicating that this flight connects countries i and j and takes time t. There is guaranteed to be at most one direct flight between any pair of countries.

The next N lines describe the passports available at each country. For $i \in \{1, 2, \ldots, N\}$, line M+1+i describes a passport of type i. Recall that a passport of type i is valid for a set of countries S_i. Line M+1+i starts with an integer $|S_i|$, the number of countries that a passport of type i is valid for, and is followed by $|S_i|$ integers, the list of countries in S_i. For every country i, it is guaranteed that $i \in S_i$.

Output format

A single integer denoting the shortest time to reach country N (Siruseri) from country 1 (Navalur). If it is not possible to reach country N from country 1, output -1.

Test Data

In all subtasks, $1 \leq M \leq \frac{N(N-1)}{2}$ and $1 \leq K \leq N$. For every pair of countries i and j connected by a direct flight that takes time t_{ij}, $1 \leq t_{ij} \leq 10^4$.

- *Subtask 1 (50 marks):* $1 \leq N \leq 70$.
- *Subtask 2 (50 marks):* $1 \leq N \leq 500$.

Sample input 1

```
4 5 2
1 2 1
1 3 1
1 4 10
2 4 5
3 4 1
3 1 2 4
4 1 2 3 4
2 1 3
1 4
```

Sample output 1

```
4
```

Sample input 2

```
4 5 1
1 2 1
1 3 1
1 4 10
2 4 5
3 4 1
3 1 2 4
4 1 2 3 4
2 1 3
1 4
```

Sample output 2

```
6
```

Time and memory limits

The time limit for this task is 2 seconds. The memory limit is 128 MB.