# Interstellar

Interstellar travel has been made possible! A few clever scientists have invented a new wormhole rocket engine that can speed up space travels by an enormous factor, so that the next star systems can be reached very quickly.

In theory at least!

Building the engine and the space ships suitable for interstellar flight probably takes a few decades. Nonetheless, the visionaries are already planning future extraterrestrial colonies and trade routes between them. One of them is Dr. S. Pace, a good friend of Lea. He focuses on a trade network between colonies and how to effectively route cargo space ships between them. As there are no colonies yet and no established space routes, the whole network must be constructed from scratch. Despite being a task with high secrecy, Dr. S. Pace invites Lea to help him with it. He knows all about her scientific passion and wants to show her state-of-the-art research. The problem they face is as follows. Cargo has to be shipped between two different colonies. In general, these can be in different star systems. To save valuable rocket fuel, the route between two star systems has to be the shortest one possible, but might include several stops in between to refill the space ship tanks since not all star system have a directed interstellar connection. For this, only interstellar connection are counted as the intrastellar ones are negligible in this context. The maximal amount of cargo units that can be shipped from one star system to another is equal to their squared (euclidean) distance. For each star system, there is only one specific colony where all the incoming interstellar flights arrive, and only one where all the outgoing interstellar flights depart. Usually, these are different colonies, so for the cargo to be shipped forward, it has to cross this star system to get from the arrival to the departure spaceport. As travelling within a star system is limited as well, Lea and Dr. S. Pace have to find a way to route the maximal possible amount of cargo within each system as well. Can they find the optimal routing paths for this problem?

## Input

The first line of the input contains an integer $t$. $t$ test cases follow, each of them separated by a blank line.

Each test case begins with a line consisting of four integers $N$ $M$ $n$ $m$, where $N$ is the number of star systems (indexed from 1 to $N$), $M$ the number of interstellar connections, $n$ the number of colonies per star system (indexed from 1 to $N \cdot n$), and $m$ the number of intrastellar connections (i.e., connections within a star system). $N$ lines follow. The $i$-th line contains three integers $x_i$ $y_i$ $z_i$, the coordinates of the $i$-th star system. $M$ more lines follow, each containing two integers $a_j$ $b_j$, denoting that there is a direct interstellar connection from star system $a_j$ to star system $b_j$. $m \cdot N$ more lines follow describing the connections within a star system ($m$ per star system), where a line contains three integers $u_k$ $v_k$ $c_k$, denoting that there is a connection between colonies $u_k$ and $v_k$ served by space ships that have a maximal cargo capacity of $c_k$. (The first $m$ of those lines belong to intrastellar connection within star system 1, the next $m$ lines belong to star system 2, and so on.)

## Output

For each test case, output one line containing "Case #$i$: $x$" where $i$ is its number, starting at 1, and $x$ is either the maximal amount of cargo units that can be shipped from colony 1 to colony $N \cdot n$, or "impossible" if there is no route at all between these two colonies.

## Constraints

- $1 \leq t \leq 20$
- $1 \leq N \leq 500$
- $0 \leq M \leq 5000$
- $1 \leq n \leq 100$
- $0 \leq m \leq 1000$
- $N = n = 1$ does not occur.

- $-10000 \leq x_i, y_i, z_i \leq 10000$ for all $1 \leq i \leq N$
- $1 \leq a_j, b_j \leq N$ for all $1 \leq i \leq M$
- $a_j \neq b_j$ for all $1 \leq j \leq M$
- $1 \leq c_k \leq 1000$ for all $1 \leq k \leq m \cdot N$
- Each star system has the same number of colonies.
- Interstellar connections are unidirectional.
- Intrastellar connections are bidirectional.
- $u_k$ and $v_k$ are in the same star system for all $1 \leq k \leq m \cdot N$.
- The $i$-th star system consists of colonies $(i-1) \cdot n + 1, \ldots, i \cdot n$.
- The arrival spaceport for the $i$-th star system is on colony $(i-1) \cdot n + 1$, the departure spaceport on $i \cdot n$.
- The shortest path is unique.

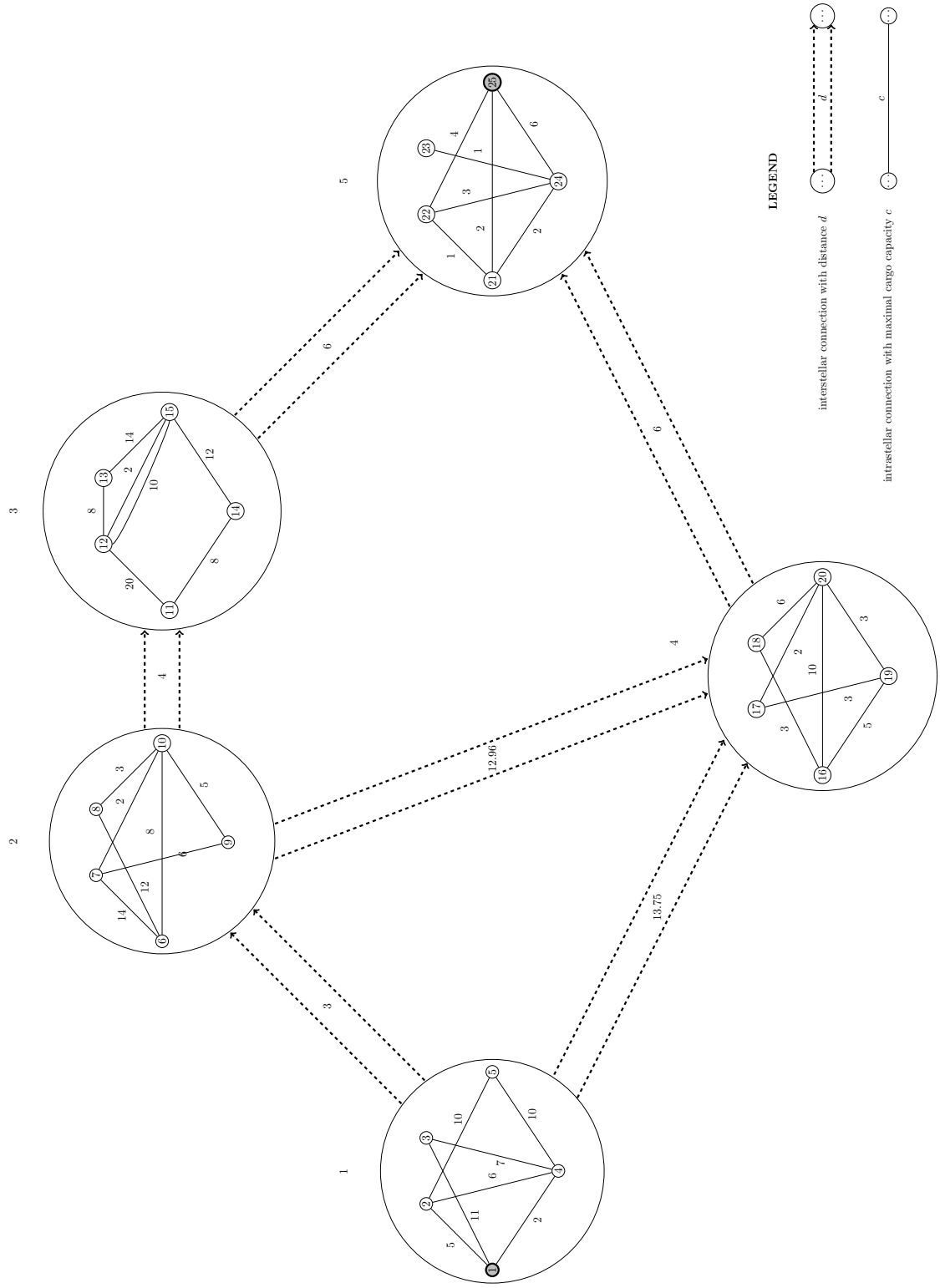


Figure 1: Sample. The cargo should be shipped from the marked colony 1 to the marked colony 25

**Sample Input 1**

```
1
5 6 5 7
0 0 0
3 0 0
3 4 0
5 8 10
3 4 6
1 2
1 4
2 3
2 4
3 5
4 5
1 2 5
1 3 11
1 4 2
2 4 6
2 5 10
3 4 7
4 5 10
6 7 14
6 8 12
6 10 8
7 9 6
7 10 2
8 10 3
9 10 5
11 12 20
11 14 8
12 13 8
12 15 10
12 15 2
13 15 14
14 15 12
16 18 3
16 19 5
16 20 10
17 20 2
18 20 6
19 17 3
19 20 3
21 22 1
21 24 2
21 25 2
22 24 3
22 25 4
24 23 1
24 25 6
```

**Sample Output 1**

```
Case #1: 5
```