Topic 3: Brain Game

Problem Statement

You have a friend called Sheldon who is a neurobiologist interested in how human brain works. Recently, Sheldon had a breakthrough in his research and proposed that human brains consist of numerous neurons connected to each other through something he called ‘synapse’. He came up with the idea that each thought in our brain are similar to messages passing through each neuron until it reaches its destination. You as a great friend decided to help him by creating a simulation program to visualize his findings.
Your simulation is very simple. Imagine each neuron as a messenger. Message will start at a selected neuron and has to reach its destination neuron through several interconnected neurons. However, Sheldon mentioned that each connection (synapse) has a different length, and time needed to pass message. You are required to calculate the distance travelled and time needed for each message.

Background information

Neuron Network Simulation Program
The network will definitely have more than 2 neurons. There is a chance that one neuron will not be connected to another neuron. This means that some message task cannot be completed.

Neuron
Each neuron serves as a node in the network. It can have zero or more connections with other neurons. However, two neurons can only have one and only one connection.

Synapse/Connection
Each synapse is similar to edges connecting two neurons. The connection has two properties, one being the length of synapse, the other is time needed for a message to travel through it.

Sample Input

Sheldon will provide you with inputs containing information about how he wants his neuron network to be and also a list of messages to be pass through the network.

The first line of the first input will be an integer n, the number of neurons that is in the network. The following lines describe n instances of neuron, each separated by a blank line. In each instance, the first line contains two integers, a and m, with a representing the ID of the neuron, while m is the number of edges connecting to the neuron. The next m lines will contain 3 numbers, A, d, and t. A is the ID of the other neuron which is connected to the current neuron, d is the distance of the edge while t is time needed for a message to pass through it.

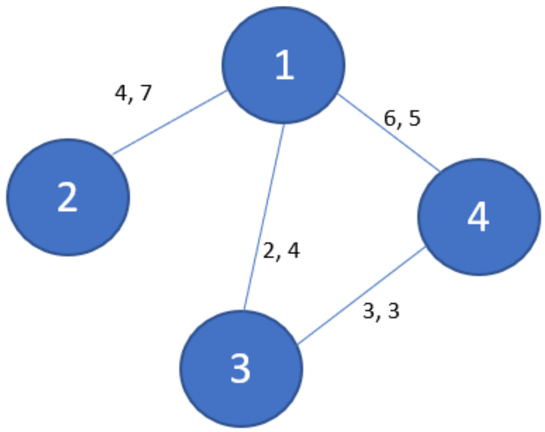
The second input contains information of the messages to be pass through. First line of the input will be an integer x, the number of messages to be pass through. The following x lines will contain 2 integers each, which represents the start point and end point of the message.

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

2 0

3 1
4 3 3

4 0

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

Note: *Feel free to modify the input format as you see fit. You may change to console prompt but do not leave out any information.*

Sample Output

The output should consist of x lines. If the message can reach its destination, print out both the distance travelled and time needed for the message, separated by a whitespace. Otherwise, print 'No path available'. The sequence of each line should follow the sequence in the input.




```
6 5
6 11
10 12
4 7
2 4
```

Explanation: - Most of the message are straight forward to pass through (only requires one synapse). Only the second and third message have to pass through multiple synapses. The distance travelled and the time needed is the summation of each synapse.

Assumption you can make

1. Each synapse is bi-directional, meaning that each synapse can pass message forward and backward.
2. The number of neurons will always be less than 20.
3. The message can pass through any neuron as long as it finally reaches its destination.
4. There will only be at most one synapse between any two neurons.

Some crazy idea

1. GUI
   - Visualize the network. Your program may show the whole network with all the interconnected neurons. Your program may also animate how the message is passed through from start to destination.

2. Unidirectional Synapse
   - Each synapse can only pass message one way. This now means that there can be at most two synapses between any two neurons, each representing forward or backward (depending on how you see it).
   - For example, the third line in the sample output ‘2 4 7’ now means that the synapse can pass message from neuron **1** to neuron **2** only. This means that certain message that could be passed originally cannot be completed now.

3. Optimization
   - Sheldon once said that the neuron will magically pick a synapse that always result in the shortest distance and/or time. Now, for each message, find out the path that follows the rule mentioned.
   - Prioritize the shortest time first. If multiple paths have the same amount of time, choose the one with the shortest distance. If there are multiple path with same amount of time and distance, then you may choose any one of it.

4. Synapse Lifetime
   - Each synapse can only pass message for a limited amount of times only before it dies and disconnect. The input of each synapse will now contain an extra integer, *i*, which range between 1 and 10.
   - Once the synapse dies, it cannot pass any message between the neurons anymore.

5. ??
   - Any idea that comes from your creative mind that might spark Sheldon’s interest.