Homework Assignment #10: Programming Exercise #2

Due Time/Date

2:20PM Tuesday, December 13, 2022. Late submission will be penalized by 20% for each working day overdue.

Problem Description

Solve Problem B "Dungeon Crawler" of the 2021 World Finals of the International Collegiate Programming Contest (see `https://icpc.global/worldfinals/problems/icpc2021.pdf` or the attachment).

Notes

This assignment constitutes 4% of your grade. You may discuss the problem with others, but copying code is strictly forbidden. **Some of you may be requested to demonstrate your program.**

Submission Guidelines

- Pack everything, excluding compiler-generated files, in a .zip file, named with the pattern "`b107050xx-alg2021-hw10.zip`".
- Upload the .zip file to the NTU COOL site for Algorithms 2022.
- If you use a Makefile, make sure that it outputs "`hw10`". Otherwise, make sure that the whole application can be compiled by a single command like "`gcc hw10.c`", "`g++ hw10.cpp`", or "`javac hw10.java`".

Grading

Your work will be graded according to its correctness and presentation. Before submission, you should have tested your program on several input cases. You should organize and document your program (preferably as comments in the source code) in such a way that other programmers, for example your classmates, can understand it. In the documentation of your program, you are encouraged to describe how you have applied the algorithmic techniques, in particular design by induction and/or reduction, learned in class.

Below is a more specific grading policy:

Criteria	Score
incomplete or doesn't compile	≤ 20
complete, compiles, but with major errors	≤ 40
complete, compiles, but with minor errors	≤ 70
correct (passing all test cases)	≤ 90
correct and reasonably efficient (at least around the class-average)	≤ 100
well-organized and with helpful code comments	$+10$

Problem B
Dungeon Crawler
Time limit: 5 seconds

Alice and Bob are in charge of testing a new escape room! In this escape room, customers are trapped in a dungeon and have to explore the entire area. The dungeon consists of n rooms connected by exactly $n-1$ corridors. It is possible to travel between any pair of rooms using these corridors.

The helix key
Image generated by DALL-E

Two of the dungeon rooms are special. One of these rooms contains a protective idol known as the "helix key." A different room contains a nasty "dome trap," which prevents the player from moving once activated. Entering the room with the trap before acquiring the key will result in the player being trapped in the dungeon forever. The player cannot start in the same room as the key or the trap.

There are q different scenarios that Alice and Bob wish to examine. In the i^{th} scenario, the player starts in room s_i, the key is in room k_i, and the trap is in room t_i. For each scenario, compute the minimum amount of time needed to explore the entire dungeon without getting trapped.

Input

The first line of input contains two integers n and q, where n ($3 \leq n \leq 2\,000$) is the number of rooms and q ($1 \leq q \leq 200\,000$) is the number of scenarios to consider. Rooms are numbered from 1 to n. The next $n-1$ lines each contain three integers u, v, and w indicating that there is a corridor between rooms u and v ($1 \leq u, v \leq n, u \neq v$) that takes time w ($1 \leq w \leq 10^9$) to traverse.

Then follow q lines: the i^{th} of these lines contains three distinct integers s_i, k_i, and t_i ($1 \leq s_i, k_i, t_i \leq n$) indicating the room where the player starts, the room with the key, and the room with the trap, respectively.

Output

For each scenario, output the minimum amount of time needed to visit every room at least once. If it is impossible to visit every room at least once, output `impossible`.

Sample Input 1	Sample Output 1
5 4 1 2 3 1 3 1 3 4 4 3 5 2 1 2 4 1 4 2 5 2 1 4 3 1	15 17 impossible 12

Sample Input 2	Sample Output 2
7 4 1 2 1 1 3 1 1 4 1 1 5 1 1 6 1 1 7 1 1 2 3 5 4 1 3 1 4 2 4 5	11 impossible 10 10