Department of Computer Science and Engineering
University of Liberal Arts Bangladesh
Final Examination
Semester – Summer 2020
Course Title: Algorithms Lab
Course Code: CSE 306 (Sec: 1)
Duration: 2:00 Hours

PLEASE ANSWER ALL QUESTIONS. **Total 30 Marks**

Name: _____ **ID:** _____

QUESTION 1 10 marks

In the year 2163, wormholes were discovered. A wormhole is a subspace tunnel through space and time connecting two-star systems. Wormholes have a few peculiar properties:

- Wormholes are one-way only.
- The time it takes to travel through a wormhole is negligible.
- A wormhole has two end points, each situated in a star system.
- A star system may have more than one wormhole end point within its boundaries.
- For some unknown reason, starting from our solar system, it is always possible to end up in any
- star system by following a sequence of wormholes (maybe Earth is the centre of the universe).
- Between any pair of star systems, there is at most one wormhole in either direction.
- There are no wormholes with both end points in the same star system.

All wormholes have a constant time difference between their end points. For example, a specific wormhole may cause the person travelling through it to end up 15 years in the future. Another wormhole may cause the person to end up 42 years in the past.

A brilliant physicist, living on earth, wants to use wormholes to study the Big Bang. Since warp drive has not been invented yet, it is not possible for her to travel from one-star system to another one directly. This can be done using wormholes, of course.

The scientist wants to reach a cycle of wormholes somewhere in the universe that causes her to end up in the past. By travelling along this cycle, a lot of times, the scientist is able to go back as far in time as necessary to reach the beginning of the universe and see the Big Bang with her own eyes. Write a program to find out whether such a cycle exists.

Input Description:

The input file starts with a line containing the number of cases c to be analysed. Each case starts with a line with two numbers n and m. These indicate the number of star systems ($1 \leq n \leq 1000$) and the number of wormholes ($0 \leq m \leq 2000$). The star systems are numbered from 0 (our solar system) through $n - 1$. For each wormhole a line containing three integer numbers x, y and t is given. These numbers indicate that this wormhole allows someone to travel from the star system numbered x to the star system numbered y, thereby ending up t ($-1000 \leq t \leq 1000$) years in the future.

Output Description:
The output consists of c lines, one line for each case, containing the word 'possible' if it is indeed possible to go back in time indefinitely, or 'not possible' if this is not possible with the given set of star systems and wormholes.

SAMPLE INPUT	SAMPLE OUTPUT
2 3 3 0 1 1000 1 2 15 2 1 -42 4 4 0 1 10 1 2 20 2 3 30 3 0 -60	possible not possible

QUESTION 2 5 marks
Interview

QUESTION 3 10 marks

We define a *modified Fibonacci sequence* using the following definition:

Given terms t_i and t_{i+1} where $i \in [1, \infty)$, term t_{i+2} is computed using the following relation:

$$t_{i+2} = t_i + (t_{i+1})^2$$

For example, if term $t_1 = 0$ and $t_2 = 1$, term $t_3 = 0 + 1^2 = 1$, term $t_4 = 1 + 1^2 = 2$, term

$t_5 = 1 + 2^2 = 5$, and so on.

Given three integers t_1, t_2, and n, compute and print term t_n of our *modified Fibonacci sequence*.

Note: The value of t_n may exceed the range of a 64-bit integer. Since the value will always be non-negative, it will be wise to use the "`unsigned long long`" datatype. Another smart strategy would be to mod each term of the formula by the macro "`ULLONG_MAX`".

Input Description:

A single line of three space-separated integers describing the respective values of t_1, t_2, and n. Here:

- $0 \leq t_1, t_2 \leq 2$
- $3 \leq n \leq 20$

- t_n may exceed the range of a 64-bit integer

Output Description:
Print a single integer denoting the value of term t_n in the modified Fibonacci sequence where the first two terms are t_1 and t_2.

SAMPLE INPUT	SAMPLE OUTPUT
0 1 5	5

QUESTION 4 5 marks
Interview

****END OF QUESTIONS****