

2026 Canadian Computing Olympiad  
Day 1, Problem 1  
**Waterloo Tag**

**Time Limit: 4 seconds**

**Memory Limit: 512 MB**

Roger and Troy are playing a game of tag at the University of Waterloo. The University of Waterloo can be represented as  $N$  buildings connected by  $M$  sidewalks. The  $i$ -th sidewalk connects buildings  $a_i$  and  $b_i$ , and is  $d_i$  metres long. There is at most 1 sidewalk between any pair of buildings. The sidewalks do not intersect (i.e. you can only move from one sidewalk to another at a building), and they might not lie on a plane (due to bridges and tunnels). Starting from any building, it is possible to reach any other building by walking along the sidewalks.

Roger starts the game of tag at building 1 and he can walk up to  $v_1$  metres per second. Roger can also wait at a building or wait anywhere on a sidewalk. Roger will walk in a way that maximizes the duration of the game of tag.

Troy will pick a building  $x$  and release a group of students at building  $x$ . The students will spread out at  $v_2$  metres per second along all sidewalks. The game of tag is over when Troy's students reach Roger.

For each building  $x$ , how long will the game of tag last?

**Input Specification**

The first line of input will consist of 4 space-separated integers  $N, M, v_1, v_2$  ( $2 \leq N \leq 2\,000$ ;  $N - 1 \leq M \leq 5\,000$ ;  $1 \leq v_1, v_2 \leq 100$ ).

The next  $M$  lines each contain 3 integers, where the  $i$ -th line contains integers  $a_i, b_i, d_i$  ( $1 \leq a_i < b_i \leq N$ ;  $1 \leq d_i \leq 10\,000$ ).

The following table shows how the 25 available marks are distributed:

Marks Awarded	Additional Constraints
3 marks	$N = 3$ and $M = 2$ .
3 marks	$N = 3$ and $M = 3$ .
7 marks	$v_1 = v_2 = 1$ and all sidewalks are 2 metres long ( $d_i = 2$ ).
7 marks	$N \leq 100$ and $M \leq 200$ .
5 marks	None.

**Output Specification**

Output  $N - 1$  lines, where the  $i$ -th line contains the duration of the game of tag in seconds if Troy releases a group of students at building  $i + 1$ . You must output the duration as a fraction in simplest terms.

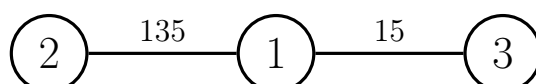
Note that an integer  $d$  is a *divisor* of an integer  $q$  if there is no remainder when  $q$  is divided by  $d$ . An integer  $z$  is a *common divisor* of integers  $x$  and  $y$  if  $z$  is a divisor of both  $x$  and  $y$ . A fraction  $x/y$  is in simplest terms if  $y$  is positive, and  $x$  and  $y$  do not have a common divisor greater than one.

**Sample Input 1**

```
3 2 1 10
1 2 135
1 3 15
```

**Output for Sample Input 1**

```
15/1
5/3
```

**Explanation of Output for Sample Input 1**

For  $x = 2$ , Roger should walk to building 3. After 15 seconds, the students tag Roger at building 3 and the game of tag is over.

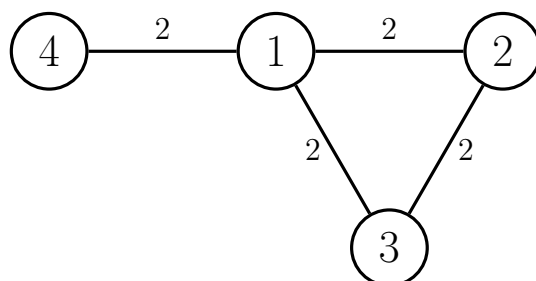
For  $x = 3$ , Roger should walk towards building 2. After  $5/3$  seconds, the students tag Roger at the sidewalk between buildings 2 and 3 and the game of tag is over. Notice that Roger walked  $1.666\dots$  metres and the students walked  $15 + 1.666\dots$  metres.

**Sample Input 2**

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

**Output for Sample Input 2**

```
4/1
4/1
5/1
```

**Explanation of Output for Sample Input 2**

For  $x = 2$ , Roger should walk to building 4.

For  $x = 3$ , Roger should walk to building 4.

For  $x = 4$ , Roger should walk to the centre of the sidewalk between buildings 2 and 3.