ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Exercise – *Tracking*

Colonel Moran is on the run after an unsuccessful assasination attempt. With a whole division of Scotland Yard led by inspector Lestrade on his trail, he needs to escape London and get to his hide-out in Dartmoor as quickly as possible. He has a map with travel times between different cities. In order to mask his smell and thereby evade pursuing dogs, he wants to travel some of the legs of the journey along rivers. Help him get to Dartmoor as quickly as possible while walking along a river at least a certain number of times. Roads may be used in either direction and—if desired—the same road may be used multiple times.

Input   The first line of the input contains the number $t \leq 100$ of test cases. Each of the t test cases is described as follows.

- It starts with a line that contains five integers n m k x y, separated by a space and such that $1 \leq n \leq 10^4$, $0 \leq m \leq 10^5$, $k \in \{1, \ldots, 10\}$, and $x, y \in \{0, \ldots, n-1\}$. Here n denotes the number of cities, m denotes the number of roads between cities, k denotes the minimum number of rivers Moran wants to travel along, x denotes the city that is the starting point, and y denotes the city that is the final destination of the journey.

- The following m lines define the roads. Each road is defined by four integers a b c d, separated by a space and such that $a, b \in \{0, \ldots, n-1\}$, $1 \leq c \leq 2^{10}$, and $d \in \{0, 1\}$. The corresponding road connects cities a and b within a travel time of c minutes. There are no roads that arrive at the same town they depart from (i.e. $a \neq b$). The last parameter d indicates whether ($d = 1$) or not ($d = 0$) the road goes along a river.

Output   For each test case output a line that contains the travel time (in minutes) of a shortest journey between the cities x and y such that at least k legs (roads) of the journey go along a river. You may assume that there is a reachable river road and that y is reachable from x. Using a river road multiple times counts multiple times towards the target k.

Points   There are four groups of test sets, worth 100 points in total.

1. For the first group of test sets, worth 20 points, you may assume that $n \leq 100$, $k = 1$, and that at most one road goes along a river and that there are no parallel roads.

2. For the second group of test sets, worth 20 points, you may assume that $n \leq 500$, $k = 1$, and that at most 10 roads go along a river and that there are no parallel roads.

3. For the third group of test sets, worth 40 points, you may assume that there are no parallel roads.

4. For the fourth (hidden) group of test sets, worth 20 points, there are no additional assumptions.

Corresponding sample test sets are contained in `testi.in/out`, for $i \in \{1, 2, 3, 4\}$. Please note that in this task the public tests contain fewer test cases than the test sets on the judge.

Sample Input	Sample Output
1	5
5 6 1 0 4	
0 1 1 0	
0 2 3 0	
1 2 1 0	
1 3 2 1	
2 4 1 0	
3 4 2 0	