3 Exchanging Money Optimally

Problem Introduction

Now, you would like to compute an optimal way of exchanging the given currency c_i into all other currencies. For this, you find shortest paths from the vertex c_i to all the other vertices.

Problem Description

Task. Given an directed graph with possibly negative edge weights and with n vertices and m edges as well as its vertex s, compute the length of shortest paths from s to all other vertices of the graph.

Input Format. A graph is given in the standard format.

Constraints. $1 \leq n \leq 10^3$, $0 \leq m \leq 10^4$, $1 \leq s \leq n$, edge weights are integers of absolute value at most 10^9.

Output Format. For all vertices i from 1 to n output the following on a separate line:

- "*", if there is no path from s to u;
- "-", if there is a path from s to u, but there is no shortest path from s to u (that is, the distance from s to u is $-\infty$);
- the length of a shortest path otherwise.

Time Limits.

language	C	C++	Java	Python	C#	Haskell	JavaScript	Ruby	Scala
time (sec)	2	2	3	10	3	4	10	10	6

Memory Limit. 512MB.

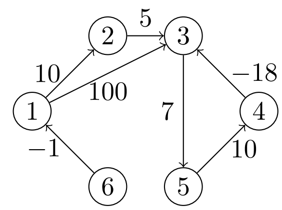
Sample 1.

Input:

```
6 7
1 2 10
2 3 5
1 3 100
3 5 7
5 4 10
4 3 -18
6 1 -1
1
```

Output:

```
0
10
-
-
-
*
```



The first line of the output states that the distance from 1 to 1 is equal to 0. The second one shows that the distance from 1 to 2 is 10 (the corresponding path is $1 \to 2$). The next three lines indicate that the distance from 1 to vertices 3, 4, and 5 is equal to $-\infty$: indeed, one first reaches the vertex 3 through edges $1 \to 2 \to 3$ and then makes the length of a path arbitrary small by making sufficiently many walks through the cycle $3 \to 5 \to 4$ of negative weight. The last line of the output shows that there is no path from 1 to 6 in this graph.

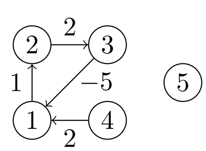
Sample 2.

Input:

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

Output:

```
-
-
-
0
*
```



In this case, the distance from 4 to vertices 1, 2, and 3 is $-\infty$ since there is a negative cycle $1 \to 2 \to 3$ that is reachable from 4. The distance from 4 to 4 is zero. There is no path from 4 to 5.