Graph Race

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

You are given an unweighted undirected connected graph with n vertices and m edges. Each vertex u has two integers, a_u and b_u assigned to it. For each vertex v such that there exists an edge between 1 and v find:

$$\max_{u \neq v}\{a_u - b_u \cdot \operatorname{dist}(u, v)\}$$

where $\operatorname{dist}(u, v)$ denotes the distance between u and v.

Input

The first line of the standard input contains two integers n and m ($2 \leq n \leq 3 \cdot 10^5$, $1 \leq m \leq 3 \cdot 10^5$), respectively denoting the number of vertices of a graph and the number of its edges.

The following n lines contain two integers each a_u and b_u ($0 \leq a_u, b_u \leq 10^9$).

The following m lines contain two integers each u and v ($1 \leq u \neq v \leq n$), representing the edges of the graph. It is guaranteed that the graph doesn't contain multiple edges.

Output

In ascending order with respect to v such that there is an edge between 1 and v, print the value $\max_{u \neq v}\{a_u - b_u \cdot \operatorname{dist}(u, v)\}$.

Example

standard input	standard output
5 4 0 0 1 1 1 1 5 1 100 40 4 1 1 2 1 3 4 5	3 3 60