Bonus2 - Sounds like a Network Problem, right?

Time Limit: 20 secs.

Problem Description

Consider a simple undirected graph consisting of n vertices and m edges. Each vertex i is associated with a non-negative integer value w_i, and the weight of each edge $(u, v) \in E$ is defined as

$$W_{u,v} := \|w_u \otimes w_v\|,$$

where $\otimes$ is the bitwise exclusive-or (XOR) operation and $\|x\|$ is the number of 1s in the binary representation of x.

In addition, we're given q constraints on the value w_i for $1 \leq i \leq n$, where each constraint is represented as a 5-tuple (t, u, i, v, j), where $t \in \{0, 1\}$ and

- if $t = 0$, then $\text{bit}(w_u, i)$ must equal $\text{bit}(w_v, j)$,
- if $t = 1$, then $\text{bit}(w_u, i)$ must not equal $\text{bit}(w_v, j)$,

and $\text{bit}(x, i)$ denotes the $(i + 1)^{th}$ least significant bit in the binary representation of x. For example, $\text{bit}(12, 1) = 0$ and $\text{bit}(12, 2) = 1$.

However, some values associated with some vertices are lost. Your task is to assign new values to these vertices such that $\sum_{(u,v)\in E} W_{u,v}$ is minimized while the q constraints are also satisfied.

Input Format

The first line consists of two integers n and m, the number of vertices and the number of edges. Each of the following m lines consists of two integers u, v, indicating that there is an edge between u and v. The next line contains n integers, indicating the values associated with each vertex. The value of -1 indicates that the value was lost.

The next line contains an integer q, the number of constraints. Each of the following q lines contains five integers t, u, i, v, j, the parameters associated with each constraint.

You may assume that

- The vertices are numbered from 0 to $n - 1$.
- $1 \leq n \leq 1000$.
- $1 \leq m \leq 5000$.
- $0 \leq w_k < 2^{16}$ for all $1 \leq k \leq n$.
- $0 \leq q \leq 8$.
- $0 \leq i, j < 16$.

Output Format

Print the minimum possible value of $\sum_{(u,v)\in E} W_{u,v}$ in a line. If it is not possible to satisfy all the constraints, print -1 instead.

Sample Input 1

```
4 4
1 3
1 2
3 2
0 3
-1 -1 60091 51514
2
1 2 0 1 5
0 2 6 0 15
```

Sample Output 1

```
13
```

Sample Input 2

```
3 2
0 1
1 2
-1 -1 -1
2
1 2 0 1 5
0 1 5 2 0
```

Sample Output 2

```
-1
```

Note.

Use bit-operators like &, $\wedge$, and >> in C/C++ for the bit operations needed in this problem.

Hint.

Notice that q is very small, and we can afford exhaustively trying all possibilities w.r.t. the q constraints. Understand what the definitions mean. Consider each bit separately and derive a suitable problem formulation.