

Making Combos

Input file: **standard input**
Output file: **standard output**
Time limit: 2 seconds
Memory limit: 1024 megabytes

Evirir the dragon is playing a video game where it will chain skills to maximize its damage output.

There are N distinct *skills*, numbered $0, 1, \dots, N-1$, that Evirir can perform. For each skill i , its *colour* is C_i and its *damage* is D_i . There are M *skill links*, which are pairs of skills (U_i, V_i) for $0 \leq i \leq M-1$.

A *combo* is a sequence of skills s_0, s_1, \dots, s_{l-1} of length $l \geq 1$ such that for $0 \leq i < l-1$, (s_i, s_{i+1}) is one of the M skill links. It is guaranteed that in the input, skill links never form a cycle. That is, it is impossible to build a combo that contains the same skill twice.

The *total power* of that combo is calculated as follows. There is a *multiplier* B ; initially $B = 1$. For $i = 0, 1, \dots, l-1$, in order:

- If $i = 0$, do nothing.
- Otherwise:
 - If skills s_i and s_{i-1} have the same colour, multiply B by 2.
 - If skills s_i and s_{i-1} have different colours, set B to 1.
- Then, the *power* of skill s_i is $D_{s_i} \times B$.

The total power of the combo is the sum of the powers of all performed skills.

For example, suppose the combo has skills $(3, 7)$, $(2, 5)$, $(4, 7)$, $(1, 7)$, $(5, 7)$, $(6, 7)$, $(3, 6)$ in that order, where (x, y) denotes a skill with damage x and colour y . Here's a breakdown:

| | s_0 | s_1 | s_2 | s_3 | s_4 | s_5 | s_6 |
|------------------|------------------|------------------|------------------|------------------|-------------------|-------------------|------------------|
| Colour C_{s_i} | 7 | 5 | 7 | 7 | 7 | 7 | 6 |
| Damage D_{s_i} | 3 | 2 | 4 | 1 | 5 | 6 | 3 |
| Multiplier B | 1 | 1 | 1 | 2 | 4 | 8 | 1 |
| Power | $3 \times 1 = 3$ | $2 \times 1 = 2$ | $4 \times 1 = 4$ | $1 \times 2 = 2$ | $5 \times 4 = 20$ | $6 \times 8 = 48$ | $3 \times 1 = 3$ |

Then the total power of the combo is $3 + 2 + 4 + 2 + 20 + 48 + 3 = 82$.

Naturally, Evirir wants to perform a *combo* with the maximum total power. To achieve this, Evirir installed a hack that can change the colour of any skill to a fixed colour T . Evirir can only use the hack at most K times (i.e. it can change the colour of at most K skills).

What is the maximum total power Evirir can achieve? If the maximum total power is strictly greater than 10^9 , output -1 .

Input

The first line contains four space-separated integers, N , M , K , and T .

Then, N lines follow, where the i -th line contains two space-separated integers, D_i and C_i .

Then, M lines follow, where the i -th line contains two space-separated integers, U_i and V_i .

Output

Output an integer, the maximum total power possible. If it is strictly larger than 10^9 , output -1 instead. If it is exactly 10^9 , you should output 10^9 .

Scoring

For all test cases, the input will satisfy the following constraints:

- $1 \leq N \leq 10^4$
- $0 \leq M \leq \min\left(10^5, \frac{N(N-1)}{2}\right)$
- $1 \leq D_i \leq 10^8$ for all $0 \leq i \leq N-1$
- $0 \leq C_i \leq N-1$ for all $0 \leq i \leq N-1$
- $0 \leq T \leq N$. **Note that T may be N** , an unused colour.
- $0 \leq K \leq N$
- $0 \leq U_i, V_i \leq N-1$ and $U_i \neq V_i$ for all $0 \leq i \leq M-1$
- The pairs (U_i, V_i) are pairwise distinct for all $0 \leq i \leq M-1$.
- It is guaranteed that *skill links* never form a cycle. That is, it is impossible to build a *combo* that contains the same skill twice.

| Subtask | Points | Additional constraints |
|---------|--------|--|
| 1 | 8 | $M = N - 1$, $(U_i, V_i) = (i, i + 1)$ for all $0 \leq i \leq M - 1$, $K = N$ |
| 2 | 9 | $M = N - 1$, $(U_i, V_i) = (i, i + 1)$ for all $0 \leq i \leq M - 1$, $K = 0$ |
| 3 | 31 | $M = N - 1$, $(U_i, V_i) = (i, i + 1)$ for all $0 \leq i \leq M - 1$, $N \leq 50$ |
| 4 | 14 | $N \leq 50$ |
| 5 | 17 | $M = N - 1$, $(U_i, V_i) = (i, i + 1)$ for all $0 \leq i \leq M - 1$, $N \leq 300$ |
| 6 | 17 | $M = N - 1$, $(U_i, V_i) = (i, i + 1)$ for all $0 \leq i \leq M - 1$ |
| 7 | 4 | — |

Examples

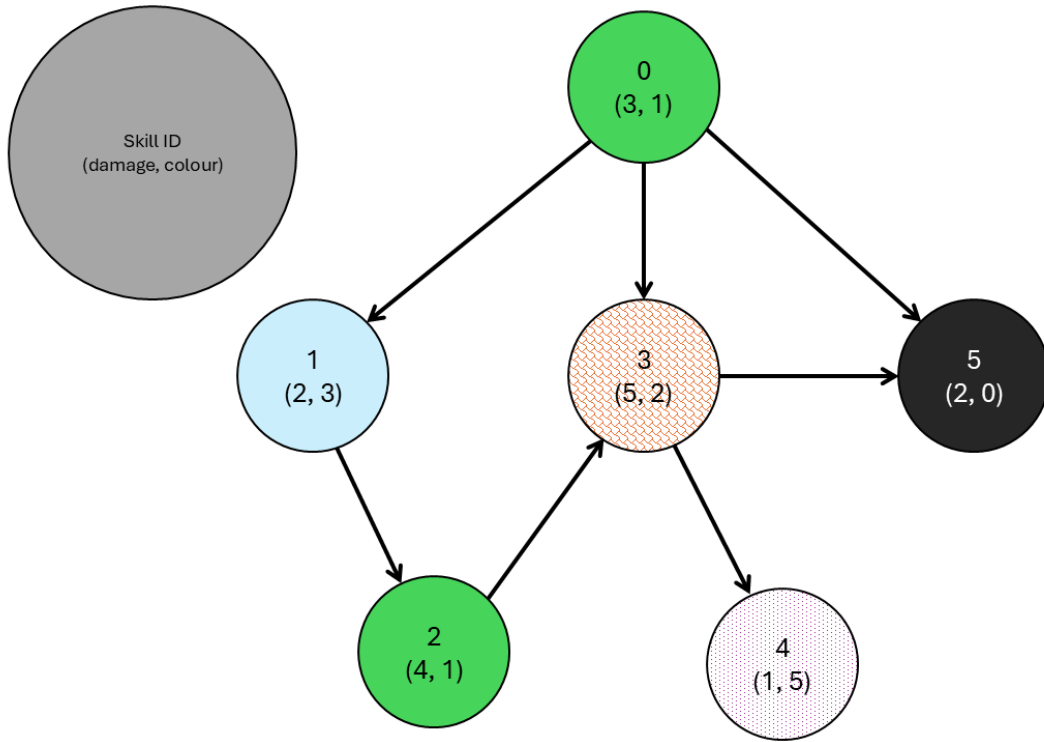
| standard input | standard output |
|--|-----------------|
| 6 7 2 1 3 1 2 3 4 1 5 2 1 5 2 0 0 1 3 4 2 3 0 3 3 5 1 2 0 5 | 65 |
| 5 4 0 5 2 0 3 1 2 0 3 0 13 0 0 1 1 2 2 3 3 4 | 65 |
| 4 3 4 0 100000000 0 100000000 1 100000000 2 100000000 3 0 1 1 2 2 3 | -1 |

Note

Example 1

This example is valid for subtask 4 and 7.

Here is a visualisation. An arrow from skill x to skill y means that there is a skill link (x, y) , i.e. Evirir can do skill y immediately after skill x . The big circle on the top left explains what each number means.



Evirir can change the colour of at most $K = 2$ skills to colour $T = 1$. It can change the colour of skills 1 and 3 to colour 1, then perform skills $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 5$. The total power is $(1 \times 3) + (2 \times 2) + (4 \times 4) + (8 \times 5) + (1 \times 2) = 65$.

An example of a non-combo is the sequence of skills $0 \rightarrow 3 \rightarrow 4 \rightarrow 5$, because $(4, 5)$ is not one of the M skill links.

Example 2

This example is valid for subtasks 2, 3, 4, 5, 6, and 7.

There are $N = 5$ skills and $M = 4$ skill links. $K = 0$, so Evirir cannot change the colour of any skill. The optimal combo is to perform skills $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4$. The total power is $(2 \times 1) + (3 \times 1) + (2 \times 1) + (3 \times 2) + (13 \times 4) = 65$.

Example 3

This example is valid for subtasks 1, 3, 4, 5, 6, and 7.

Since $K = 4$, Evirir can change the colours of skills 1, 2, and 3 to colour $T = 0$. The optimal combo is to perform skills $0 \rightarrow 1 \rightarrow 2 \rightarrow 3$. The total power is $(10^8 \times 1) + (10^8 \times 2) + (10^8 \times 4) + (10^8 \times 8) > 10^9$. Since the maximum possible power is strictly larger than 10^9 , output -1 .