Problem E. Maximum Sum Path

Problem Description

Given a graph G with n vertices numbered 1 to n and m directed edges (u_j, v_j). Each directed edge (u_j, v_j) is colored black or white, denoted as c_j ($c_j \in \{\texttt{B}, \texttt{W}\}$). Each room has a requirement ℓ_i, meaning you can leave room i only if you entered room i with star count $\geq \ell_i$. Each edge has a certain number of stars w_j that can be obtained the first time it is traversed.

You can choose any room i with $\ell_i = 0$ as the starting room and a color as the starting color. After that, you must alternate between black and white edges.

What is the maximum number of stars you can collect? For each room i, please output the maximum number of stars $star_i$ that can be collected if you end up in room i.

It is guaranteed that even with an infinite number of stars, it is not possible to traverse this graph infinitely.

Input Format

- line 1: n m
- line 2: ℓ_1 ℓ_2 $\ldots$ ℓ_n
- line $2+j$ ($1 \leq j \leq m$): u_j v_j c_j w_j

Output Format

- line 1: $star_1$ $star_2$ $\ldots$ $star_n$

Constraints

- $1 \leq n \leq 100\,000$.
- $1 \leq m \leq 300\,000$.
- $0 \leq \ell_i \leq 10^9$ for $i = 1, 2, \ldots, n$.
- $1 \leq u_j, v_j \leq n$ for $j = 1, 2, \ldots, m$.
- $0 \leq w_j \leq 10\,000$ for $j = 1, 2, \ldots, m$.
- $c_j \in \{\texttt{B}, \texttt{W}\}$ for $j = 1, 2, \ldots, m$.
- It is guaranteed that even with an infinite number of stars, it is not possible to traverse this graph infinitely.
- All input values except c_js are integers.

Subtasks

1. (15 points) $n \leq 5$; $m \leq 10$.
2. (40 points) $n \leq 500$; $m \leq 2000$.
3. (45 points) No additional constraints.

No.	Testdata Range	Time Limit (ms)	Memory Limit (KiB)
Samples	1-7	1000	262144
1	1-22	1000	262144
2	1-37	1000	262144
3	1-57	1000	262144

Samples

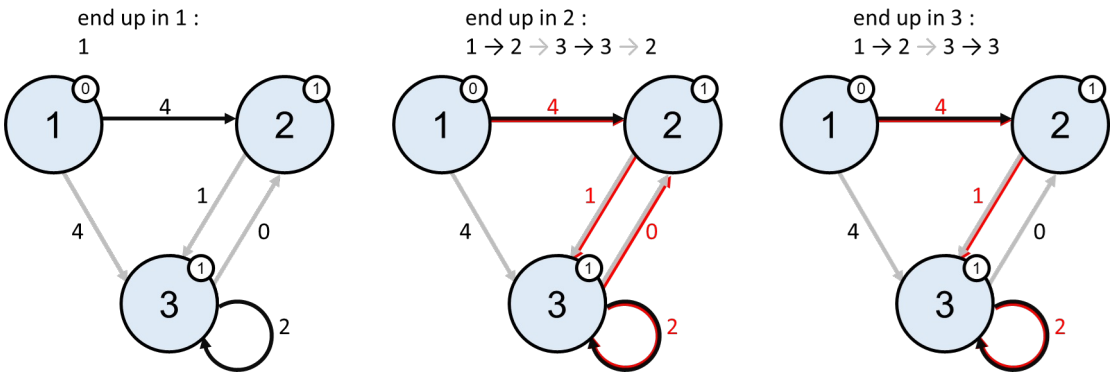
Sample Input 1

```
3 5
0 1 1
1 2 B 4
2 3 W 1
3 2 W 0
3 3 B 2
1 3 W 4
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 1

```
0 7 7
```



Sample Input 1

You can only start from room 1.

- There is no way to go back to room 1 again, thus the maximum star you can collect if you end in room 1 is 0.
- You can walk through black edge 1 to earn 4 stars, white edge 2 to earn 1 star, black edge 4 to earn 2 stars, and white edge 3 to earn 0 stars. The maximum star you can collect if you end in room 2 is 7.
- You can walk through edges 1, 2, 4 to earn 7 stars and end in room 3.

Sample Input 2

```
3 5
0 5 1
1 2 B 4
2 3 W 1
3 2 W 0
3 3 B 2
1 3 W 4
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 2

```
0 6 6
```

- The route in the Sample 1 is not valid. After the first edge you will be in room 2 with 4 star, since $4 < \ell_2 = 5$ stars, you can not leave room 2.
- You can walk through edges 5, 4, 3 to earn 7 stars and end in room 2.
- You can walk through edges 5, 4 to earn 7 stars and end in room 3.

Sample Input 3

```
3 5
0 5 5
1 2 B 4
2 3 W 1
3 2 W 0
3 3 B 2
1 3 W 4
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 3

```
0 4 4
```

Sample Input 4

```
4 4
4 0 9 0
3 2 W 5
1 2 W 7
4 1 B 4
4 3 B 7
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 4

```
4 11 7 0
```

Sample Input 5

```
5 9
0 0 0 0 0
1 2 B 7
1 3 W 9
1 4 B 9
2 3 B 4
2 3 W 1
2 4 W 3
3 4 W 5
3 5 B 5
4 5 W 6
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 5

```
0 7 9 10 15
```

Sample Input 6

```
2 2
0 0
1 2 B 1234
2 1 B 9876
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 6

```
9876 1234
```

Sample Input 7

```
1 2
1000000000
1 1 B 10000
1 1 B 9999
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 7

```
0
```

There might be the case that you can not enter any room from the start.