3_電車難題(The Trolley Dilemma)

(10分)

時間限制: 1 second
記憶體限制: 256 MB

題目敘述

YTP 國有一個電車軌道系統，我們可以用一個 N 個點的有根樹來形容這個系統，樹上的每個節點代表著一個中繼站或是終點站，而節點和節點之間的邊代表連接兩者的軌道。節點 1 是這個有根樹的根節點，每個節點會有若干個子節點，如果一個節點沒有子節點，則稱它為一個終點站，否則稱它為一個中繼站。

每個中繼站必須選擇恰好一條連接它和子節點的軌道作為**主要軌道**，一台電車會從根節點一路行駛主要軌道直到抵達某個終點站為止。一開始每個中繼站已經選擇了它們目前的主要軌道。

YTP 國的氣球倫理學家 Joylintp 提出了以下的 K-電車難題：現在每條軌道上各綁了若干顆氣球，當電車行駛過一個軌道時，軌道上的氣球會全部破掉。如果能改變最多 K 個中繼站所選的主要軌道，該怎麼做比較好？

因為氣球倫理道德實在是太複雜了，所以這裡我們考慮一個簡單的目標：最少化破掉的氣球個數。

對於所有 $K = 0, 1, 2, \ldots, N-1$，請回答在 K-電車難題中，破掉的氣球個數最少能是多少？

輸入格式

第一行輸入一個正整數 N，代表電車軌道系統的節點數。

接下來輸入 $N-1$ 行，每一行會輸入四個整數 u, v, w，代表節點 u 有子節點 v，它們之間的軌道上有 w 顆氣球。

最後輸入一行，這行有 N 個整數 $m_1, m_2, \ldots, m_N$。如果節點 i 為終點站，則 $m_i = 0$，否則節點 i 為中繼站且它的主要軌道為節點 i, m_i 之間的軌道。

輸出格式

輸出 N 行，第 i 行輸出一個整數，代表當 $K = i - 1$ 時，在 K-電車難題中，破掉的氣球個數最小值。

資料範圍

- $2 \leq N \leq 2 \times 10^5$
- $1 \leq u, v \leq N$
- $u \neq v$
- $0 \leq w \leq 10^9$
- $0 \leq m_i \leq N$
- 保證輸入的所有軌道形成一個以節點 1 為根節點的有根樹
- 如果 $m_i = 0$，則節點 i 一定是終點站
- 如果 $m_i > 0$，則節點 i, m_i 之間的軌道一定存在
- 保證每個中繼點恰有一個主要軌道

測試範例

輸入範例 1

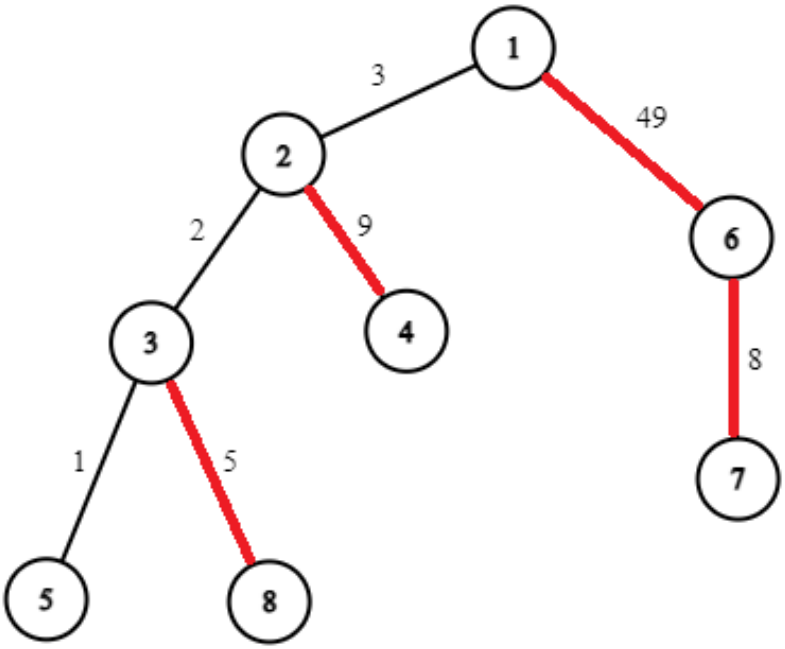
```
8
1 2 3
2 3 2
2 4 9
3 5 1
1 6 49
6 7 8
3 8 5
6 4 8 0 0 7 0 0
```

輸出範例 1

```
57
12
10
6
6
6
6
6
```

範例說明

以下是測試範例的樹狀結構，其中紅色的邊為主要軌道。



$K = 0$：電車一定是經過節點 $1 \to 6 \to 7$。

$K = 1$：將中繼站 1 的主要軌道換成和 2 之間的軌道後，電車會經過節點 $1 \to 2 \to 4$。

$K = 2$：將中繼站 $1, 2$ 的主要軌道都換成另一個軌道後，電車會經過節點 $1 \to 2 \to 3 \to 8$。

$K \geq 3$：將中繼站 $1, 2, 3$ 的主要軌道都換成另一個軌道後，電車會經過節點 $1 \to 2 \to 3 \to 5$。

3_The Trolley Dilemma

(10 points)

Time Limit: 1 second
Memory Limit: 256MB

Statement

YTP Nation has a trolley track system that can be represented as a rooted tree with N nodes. Each node in the tree represents either a relay station or a terminal station, and the edges between the nodes represent the tracks connecting them. Node 1 is the root of this tree. Each node may have several child nodes. If a node has no child nodes, it is called a terminal station, otherwise, it is called a relay station.

Each relay station must select exactly one track connecting it to one of its child nodes as the **main track**. A trolley will travel from the root node along the main tracks until it reaches a terminal station. Initially, each relay station has already selected its current main track.

Joylintp, a balloon ethicist from YTP Nation, proposed the following K-trolley dilemma: each track has a certain number of balloons tied to it. If a trolley travels along a track, all balloons on that track will be popped. If it is possible to change the main track of up to K relay stations, what is the best way to do so?

Since balloon ethics are too complex, we consider a simple objective here: minimize the number of popped balloons.

For all $K = 0, 1, 2, \ldots, N-1$, determine the minimum number of popped balloons in the K-trolley dilemma.

Input Format

The first line contains a positive integer N, representing the number of nodes in the trolley track system.

The next $N-1$ lines each contain four integers u, v, w, indicating that node u has a child node v, and there are w balloons tied on the track between them.

The final line contains N integers $m_1, m_2, \ldots, m_N$. If node i is a terminal station, then $m_i = 0$; otherwise, node i is a relay station and its main track is the track between node i and node m_i.

Output Format

Output N lines. The i-th line should contain a single integer, representing the minimum number of popped balloons when $K = i - 1$ in the K-trolley dilemma.

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $1 \leq u, v \leq N$
- $u \neq v$
- $0 \leq w \leq 10^9$

- $0 \leq m_i \leq N$
- It is guaranteed that the input tracks form a rooted tree with node 1 as the root node.
- If $m_i = 0$, then node i is guaranteed to be a terminal station.
- If $m_i > 0$, then the track between node i and node m_i is guaranteed to exist.
- Each relay station has exactly one main track.

Test Cases

Input 1

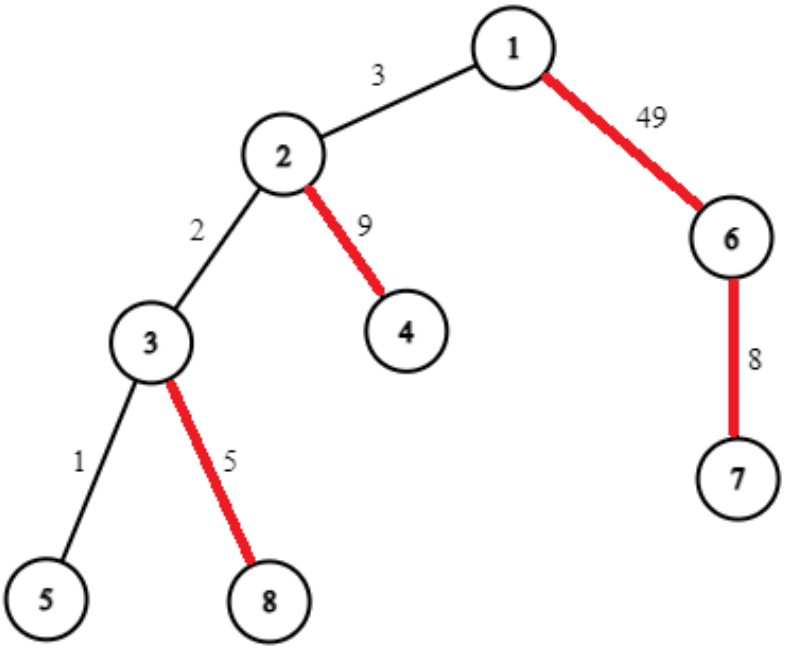
```
8
1 2 3
2 3 2
2 4 9
3 5 1
1 6 49
6 7 8
3 8 5
6 4 8 0 0 7 0 0
```

Output 1

```
57
12
10
6
6
6
6
6
```

Illustrations

Below is the tree structure of the sample testcase. The initial main tracks are marked in red.



$K = 0$: The trolley must travel through nodes $1 \to 6 \to 7$.

$K = 1$: After changing the main track of relay station 1 to the track between 1 and 2, the trolley will travel through nodes $1 \to 2 \to 4$.

$K = 2$: After changing the main tracks of relay stations 1 and 2 to other tracks, the trolley will travel through nodes $1 \to 2 \to 3 \to 8$.

$K \geq 3$: After changing the main tracks of relay stations 1, 2, and 3 to other tracks, the trolley will travel through nodes $1 \to 2 \to 3 \to 5$.