

7_禁忌之島 (Forbidden Island)

(3 分/17 分)

時間限制: 5 seconds

記憶體限制: 1024 MB

題目敘述

在禁忌之島中，一共有 N 個城市。除了禁忌之島的首都以外，每個城市皆被一個上屬城市管轄，且一個城市可以有多個直屬下屬城市。首都位於編號 1 的城市。

禁忌之島時常舉辦嘉年華，當某座城市作為嘉年華的舉辦方時，該城市所有下屬們（包含直屬下屬的下屬，以此類推）也將會一起舉辦嘉年華。

在每座城市在年初有 A_i 元的經費。為了準備嘉年華，舉辦的城市們會需要進行大量的購物。每座城市將會用自己的經費大量購買相同的物品，直到經費不足。

在某些時候，某座城市可能覺得某個上屬表現不佳，轉而跑去找另外一個城市做為上屬。

在西元 998244353 年中，一共發生了 Q 筆事件。事件的種類一共有三種，描述如下：

- 城市 u 舉辦嘉年華（他的所有下屬也將一同舉辦），並購買的物品單價為 x 元。
- 城市 u 的上屬更改成 v 。
- 詢問今年以城市 u 與他下屬們（包含直屬下屬的下屬，以此類推）一共買了多少個物品，並對答案 $(\text{mod } 998244353)$ 。

輸入格式

輸入的第一行為一個正整數 N ，代表一共有 N 個城市。

第二行一共有 $N - 1$ 個正整數，第 i 個整數代表編號為 $i + 1$ 的上屬城市的編號 p_i 。

第三行一共有 N 個正整數 A_i ，代表城市 i 在年初的經費為 A_i 元。

第四行為一個正整數 Q ，代表在第 998244353 年，一共發生了 Q 筆事件。

接下來 Q 行，每行包含若干個整數，這 Q 行中的第 j 行的第一個整數 k 代表了第 j 個事件的種類：

- 當 $k = 1$ ，代表發生了第一種事件，接下來會有兩個整數 u, x ，意義與題目敘述相同。
- 當 $k = 2$ ，代表發生了第二種事件，接下來會有兩個整數 u, v ，意義與題目敘述相同。
- 當 $k = 3$ ，代表發生了第三種事件，接下來會有一個整數 u ，意義與題目敘述相同。

輸出格式

對於每個第 3 種的事件，輸出一個正整數，代表以城市 u 做為舉辦方的嘉年華之中，購買物品的數量，並對答案 $\text{mod } 998244353$ 。

資料範圍

- $2 \leq N, Q \leq 3 \cdot 10^5$

- $1 \leq u, v \leq N$
- $p_i < i, 1 \leq i \leq N$
- $0 \leq A_i < 998244353$
- $1 \leq x < 998244353$

子任務

- 子任務 1 滿足 $N, Q \leq 5000$ 。
- 子任務 2 無額外限制。

測試範例

範例輸入 1

```
3
1 1
10 10 10
10
3 1
1 1 3
3 1
3 2
3 3
2 2 3
1 3 1
3 1
3 2
3 3
```

範例輸出 1

```
0
9
3
3
11
4
8
```

範例輸入 2

```
8
1 1 3 4 3 5 1
544420781 729609648 110923301 240695139 305509796 177030453 789149504 251576103
11
3 6
1 4 100
```

```

2 7 2
1 6 48763
3 5
2 2 6
1 2 114514
2 5 7
3 3
2 2 6
3 1

```

範例輸出 2

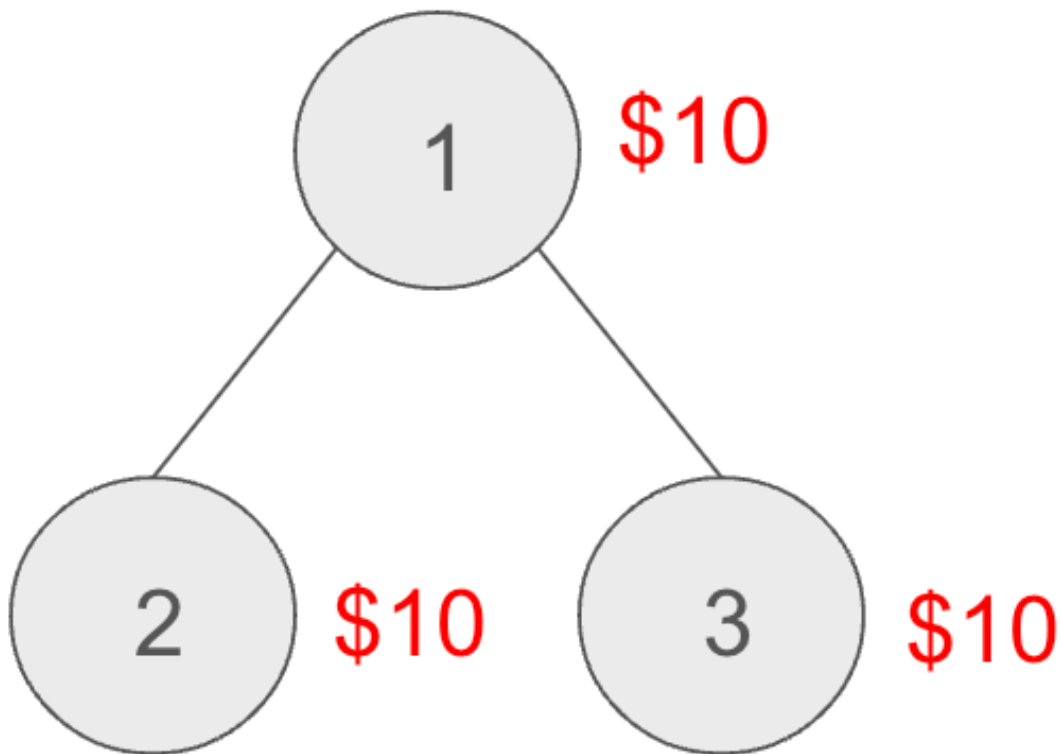
```

0
3055097
13363544
13363544

```

範例說明

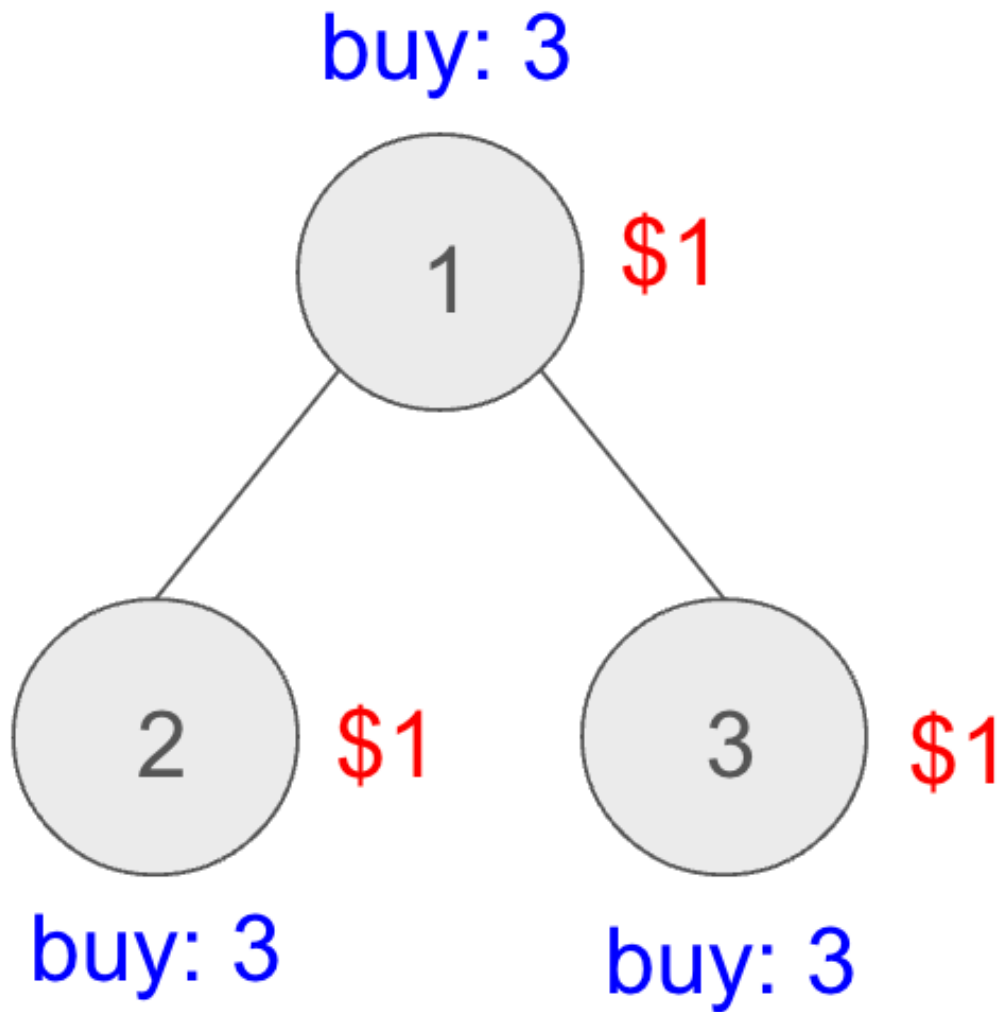
在第一筆範例測資中，一開始的城市圖如下：



第一次事件時，因為還沒有舉辦任何的嘉年華，因此輸出 0。

第二次事件是由城市 1 舉辦嘉年華，並購買價錢為 3 的商品，因此：

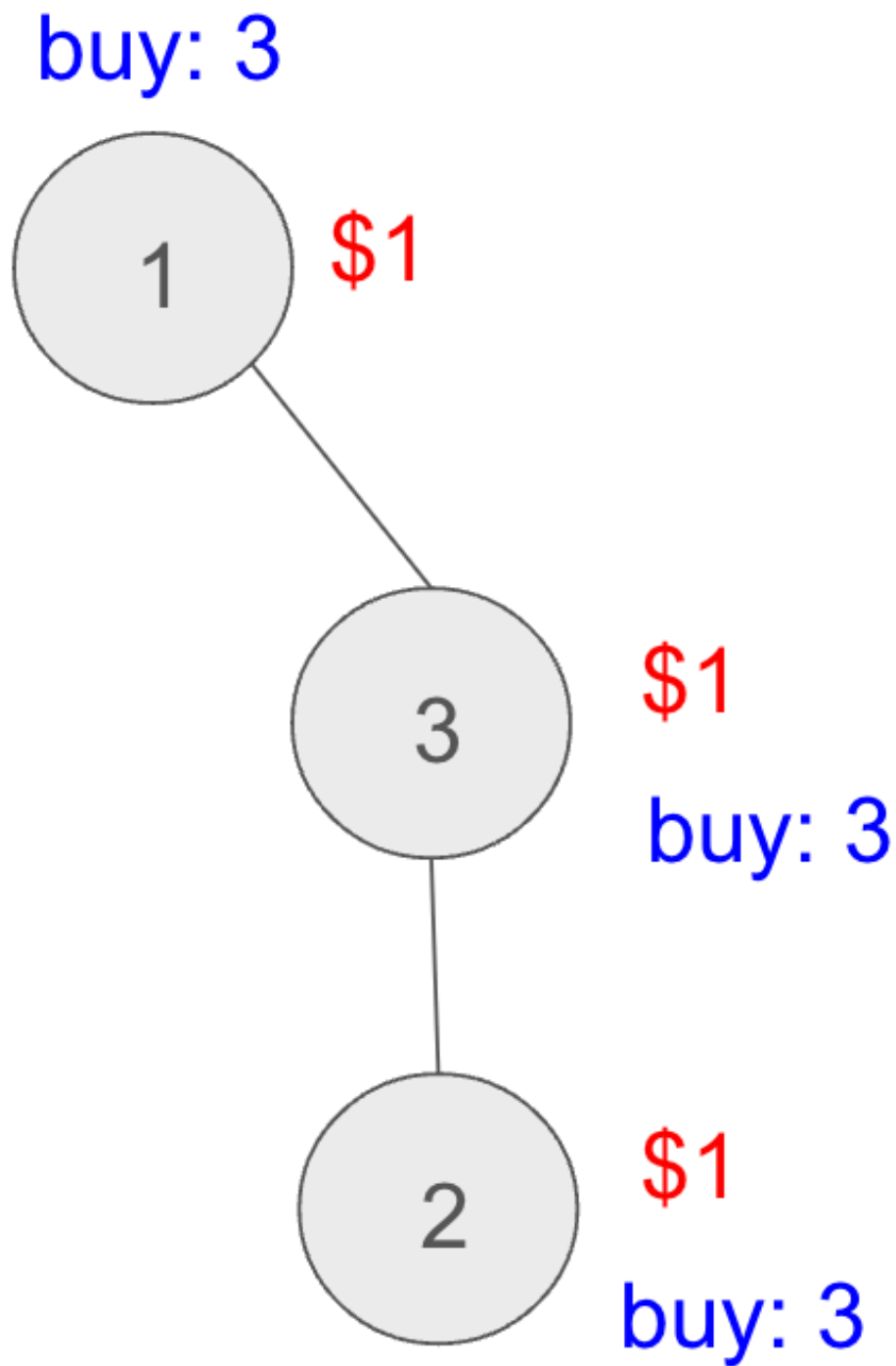
- 主辦城市 1 購買了 3 個商品，經費剩餘 1。
- 城市 2 是 1 的下轄城市，因此也要一起舉辦嘉年華，並購買了 3 個商品，經費剩餘 1。
- 城市 3 是 1 的下轄城市，因此也要一起舉辦嘉年華，並購買了 3 個商品，經費剩餘 1。



第三到五次事件就是詢問各個城市與其下轄城市購買的商品總和，對於 1 來說，他有兩個下轄城市 2，3，一共購買了 9 個商品。

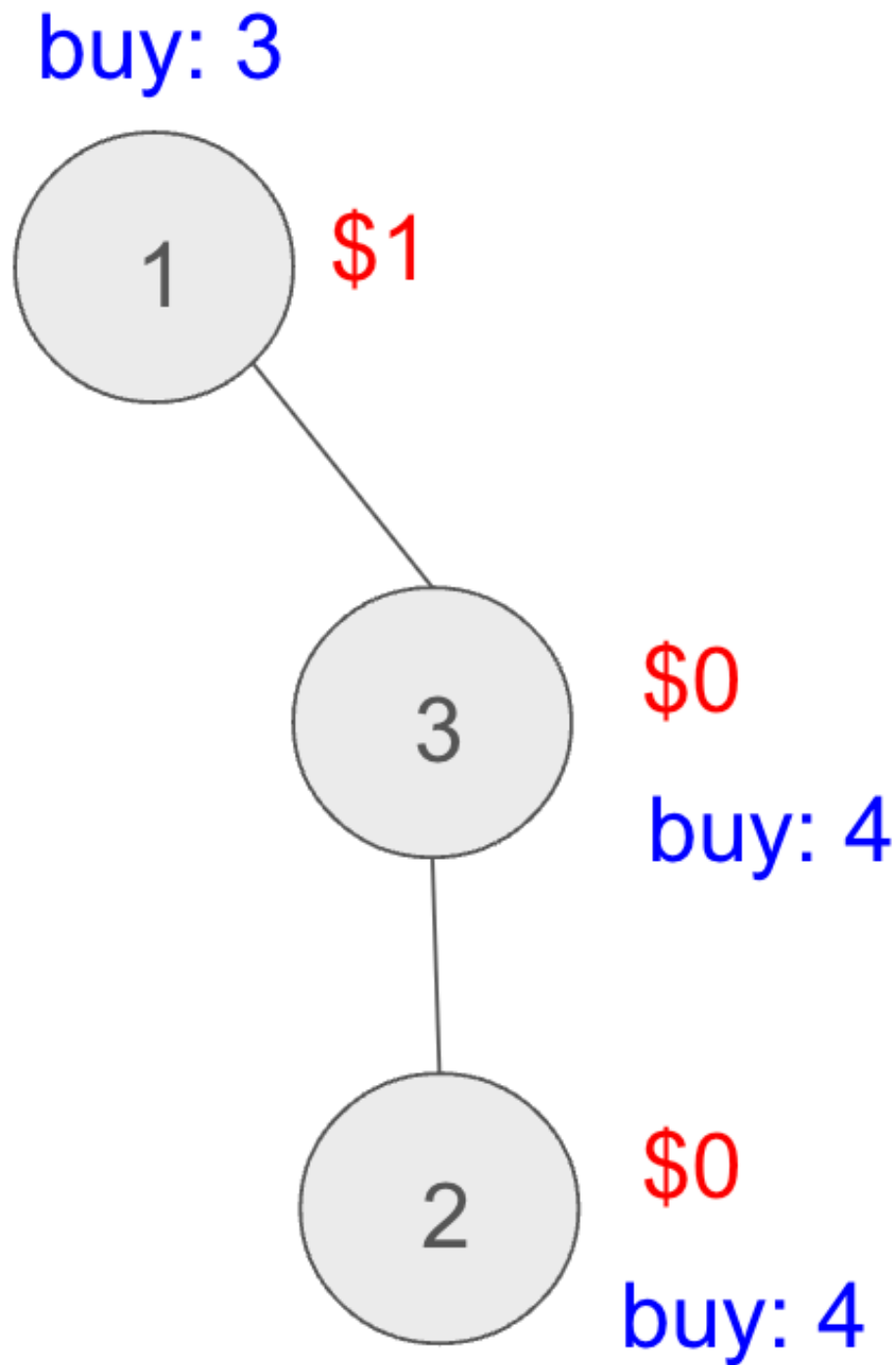
對於 2, 3 來說，由於他們都沒有下轄城市，因此只要輸出自己購買的商品數量 3 即可。

接下來的第六次事件中，城市 2 變成城市 3 的下轄城市，此時城市圖為：



第七次事件中，由城市 3 舉辦嘉年華，購買價值為 1 的商品，因此：

- 主辦城市 3 購買了 1 個商品，經費剩餘 0。
- 城市 2 是 3 的下轄城市，因此也要一起舉辦嘉年華，並購買了 1 個商品，經費剩餘 0。



剩下的事件就是詢問各個城市與其下轄城市購買的商品總和，對於 1 來說，他有兩個下轄城市 2，3，一共購買了 11 個商品。

對於 3 來說，他有一個下轄城市 2，因此總共購買了 8 個商品。

對於 2 來說，由於他沒有下轄城市，因此只要輸出自己購買的商品數量 4 即可。

7_Forbidden Island

(3 points/17 points)

Time Limit: 5 seconds

Memory Limit: 1024 MB

Statement

There are N cities on the Forbidden Island. Except for the capital, every city is governed by a parent city. A parent city may have multiple child cities. The capital is always numbered as city 1.

The residents of the Forbidden Island frequently hold carnivals. When a city hosts a carnival, every offspring of that city will participate in the carnival together.

Initially, each city has A_i dollars as the budget for the carnival. To hold a carnival, every participating city will buy items until they run out of budget.

Occasionally, a city may decide that its parent city is unsuitable and choose a different city as its new parent.

In B.C. 998244353, there are Q events happening on the Forbidden Island. Here is a description of the three types of events:

1. The u -th city hosts a carnival (along with its offspring cities, if any), and they buy items priced at x dollars each.
2. The u -th city designates the v -th city as its new parent.
3. Query the total number of items bought by the u -th city and its offspring. The answer should be modulo 998244353.

Input Format

The first line contains a single integer N , representing the number of cities.

The second line contains $N - 1$ integers, where the i -th integer represents the parent city of the $i + 1$ -th city (the 1-st city is always the capital and have no parent city).

The third line contains N integers, representing the initial budget A_i for each cities.

The fourth line contains a single integer Q , representing the number of events.

For following Q lines, each line represent one event. For each line, the first integer represent the event type k .

- If $k = 1$, it represent the first event, and the line contains three integers: 1, u , and x . This means the u -th city hosts a carnival and buys items priced at x dollars each.
- If $k = 2$, it represent the second event, and the line contains three integers: 2, u , and v . This means the u -th city changes its parent to the v -th city.
- If $k = 3$, it represent the third event, and the line contains two integers: 3 and u . This means you should output the total number of items bought by the u -th city and its offspring.

Output Format

For every third event, output a single integer on a new line representing the total number of items bought by the u -th city and its offspring. The result should be modulo 998244353.

Constraints

- $2 \leq N, Q \leq 3 \cdot 10^5$
- $1 \leq u, v \leq N$
- $p_i < i, 1 \leq i \leq N$
- $0 \leq A_i < 998244353$
- $1 \leq x < 998244353$

Subtasks

- Subtask 1 satisfies $N, Q \leq 5000$.
- Subtask 2 has no additional constraints.

Test Cases

Input 1

```
3
1 1
10 10 10
10
3 1
1 1 3
3 1
3 2
3 3
2 2 3
1 3 1
3 1
3 2
3 3
```

Output 1

```
0
9
3
3
11
4
8
```


Input 2

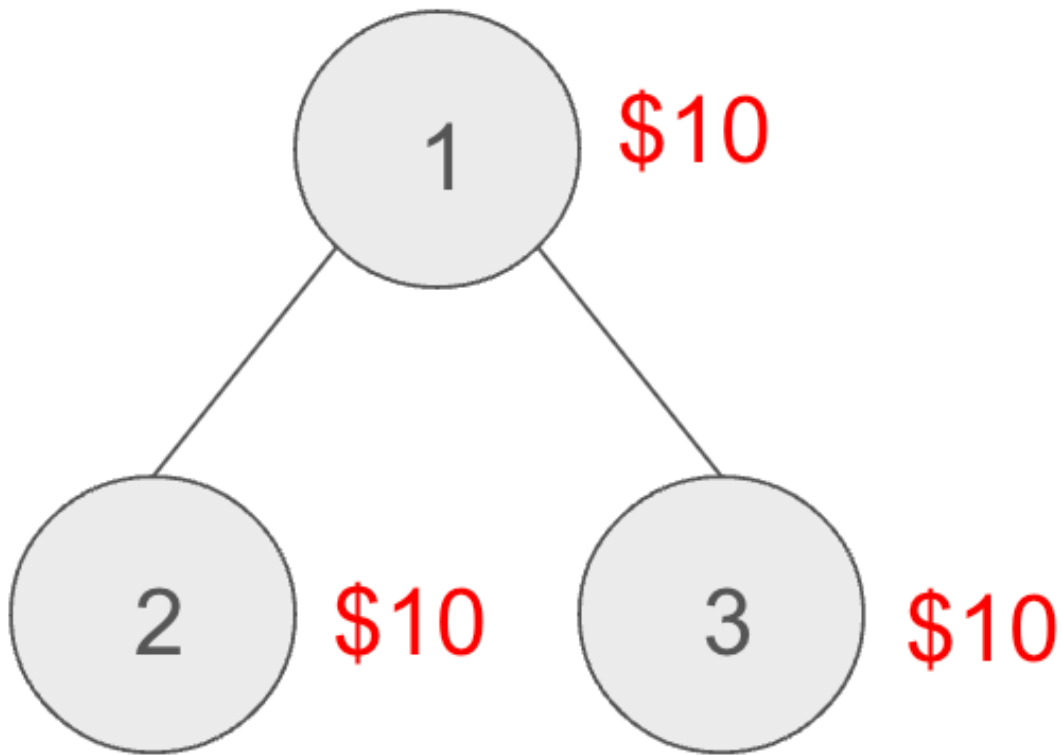
```
8
1 1 3 4 3 5 1
544420781 729609648 110923301 240695139 305509796 177030453 789149504 251576103
11
3 6
1 4 100
2 7 2
1 6 48763
3 5
2 2 6
1 2 114514
2 5 7
3 3
2 2 6
3 1
```

Output 2

```
0
3055097
13363544
13363544
```

Illustrations

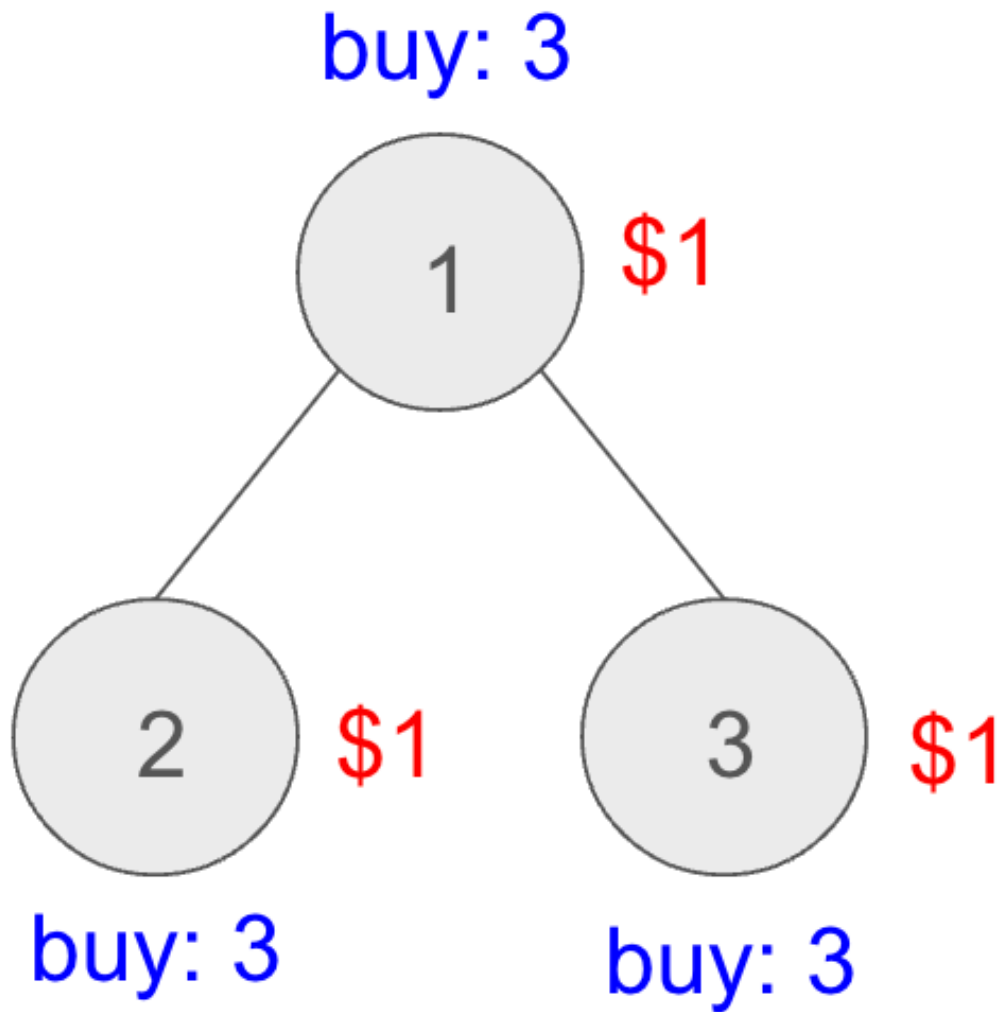
In the first example test case, the initial city graph is as follows:



During the first event, since no carnivals have been held yet, the output is 0.

For the second event, city 1 hosts a carnival and buys items priced at 3. Therefore:

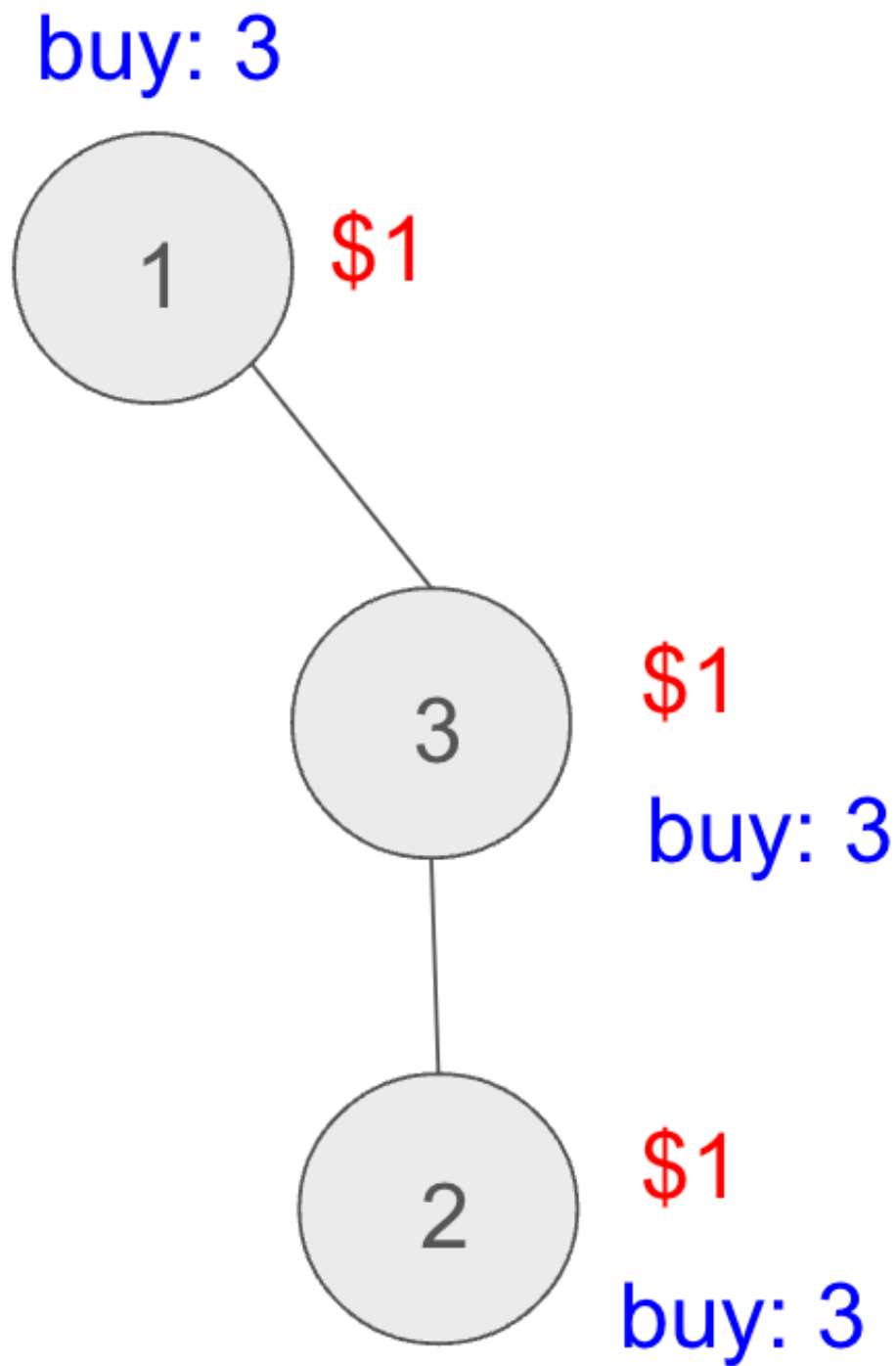
- The host city 1 buys 3 items, leaving a budget of 1.
- City 2 is offspring city of city 1, so it also participates in the carnival and buys 3 items, leaving a budget of 1.
- City 3 is offspring city of city 1, so it also participates in the carnival and buys 3 items, leaving a budget of 1.



Events three to five are queries about the total number of items bought by each city and its offsprings. For city 1, which has two offspring cities (2 and 3), the total number of items bought is 9.

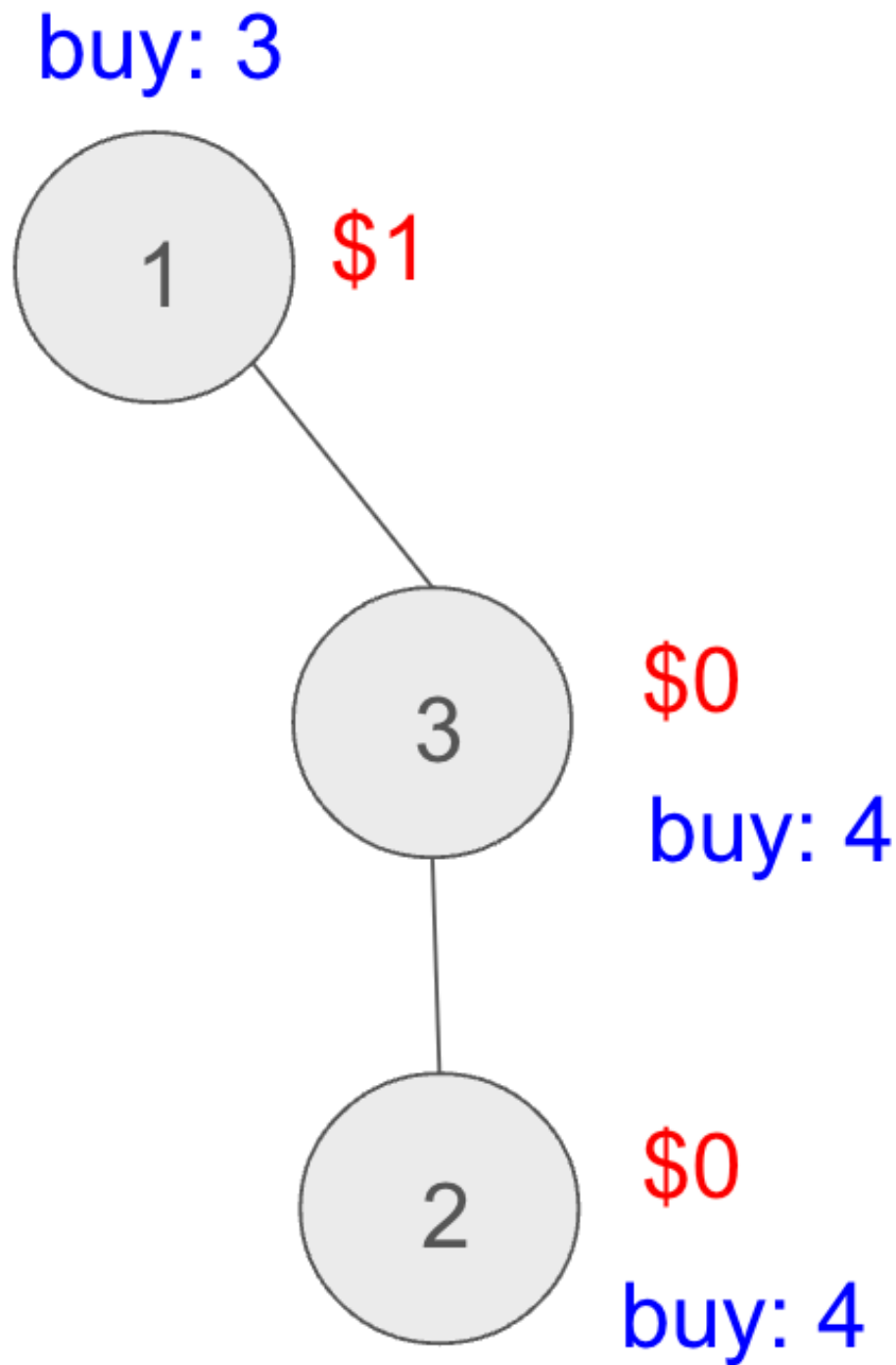
For cities 2 and 3, since they have no offspring, the output is simply the number of items each bought, which is 3.

In the sixth event, city 2 becomes a subordinate of city 3, and now the city graph is as follows:



In the seventh event, city 3 hosts a carnival and buys items priced at 1. Therefore:

- The host city 3 buys 1 item, leaving a budget of 0.
- City 2 is offspring city of city 3, so it also participates in the carnival and buys 1 item, leaving a budget of 0.



The remaining events are queries about the total number of items bought by each city and its offsprings. For city 1, which has two subordinates (2 and 3), the total number of items bought is 11.

For city 3, which has one offspring (2), the total number of items bought is 8.

For city 2, since it has no offspring, the output is simply the number of items it bought, which is 4.