Problem E. Path of the Wealth

- 2023.11.04 08:45 Update: Added Sample 3.
- 2023.11.04 08:45 Update: Updated problem statement.

Problem Description

Intrigued by the famous (or maybe notorious) "*Neko-chan Chronicle*," you couldn't wait to know what happened after the HallowLive squad beat the final trial. Therefore, you dig into its next chapter, Chapter 76, the "Path of the Wealth."

In the "*Path of the Wealth*," the squad members faced with another puzzle consisting of several mazes, where the treasures are distributed in several rooms. After exploration, Neko-chan finds a sign at the entrance, which reads:

Brave warriors came along,

To claim treasures sleep for a long while.

Marine, the greatest pirate, stand in their way,

Waiting for her next innocent prey.

With ancient artifacts closely held,

They faced their fears and finally prevailed.

Remember my word, brave warriors,

Infinite wealth represents the ultimate power.

The knowledgeable scholar, Peko-chan, translate the ancient poem into modern language:

- There are several rooms in each maze, placed with gold or artifact.
- To defeat ***Marine, the greatest pirate,*** they have to claim as much gold to smash the gold on her face.
- There are also rooms placed with an artifact, which will multiply the wealth of the warriors by specific times.
- You must claim the gold/artifact once you entered the room, and the room will not be reset.

Careful Laffey also finds that there are t mazes in total, each has n rooms. In each maze, room i has exactly one prerequisite room p_i which should be visited before room i. Only room 1 has $p_1 = 0$, indicating that it can be visited directly in the beginning.

Initially, the HallowLive squad has only 1 gold. Can you help Neko-chan calculate the maximum amount of gold they can take away in the maze and the right order to go through each maze?

Input Format

- line 1: t

There will be t blocks following by, each describing a maze. The format of the block is as below:

- line 1: n

n denotes the number of rooms in the maze.

- line 2: p_1 p_2 $\ldots$ p_n

Each denote the index of the previous room connected to the current one.

- line $2+i$ ($1 \leq i \leq n$): c_i v_i

c_i denotes whether the room has a treasure or an artifact, v_i denotes the value it contains.

Output Format

Print t blocks, one for each testcase. The format of the block is as below:

- line 1: the maximum gold the HallowLive squad can earn. If it is at least 10^{18}, output `infinite`.
- line 2: ℓ_1 ℓ_2 $\ldots$ ℓ_n: the orders in your plan. If the first line is `infinite`, you should output any valid plan that can earn at least 10^{18} gold.

Constraints

- $1 \leq t \leq 40$.
- $3 \leq n \leq 5000$.
- $p_1 = 0$.
- $1 \leq p_i < i$ for $i = 2, 3, \ldots, n$.
- $c_i \in \{\texttt{+}, \texttt{x}\}$ for $i = 1, 2, \ldots, n$.
- $1 \leq v_i \leq 9$ for $i = 1, 2, \ldots, n$.
- All input values except c_i ($1 \leq i \leq n$) are integers.

Subtasks

1. (10 points) $n \leq 8$; the maximum answer is less than 10^{18}.
2. (30 points) $n \leq 300$; the maximum answer is less than 10^{18}.
3. (10 points) $p_i = 1$ for $i = 2, 3, \ldots, n$.
4. (20 points) n is odd; $p_i = 1$ and $c_i =$ `x` for $i = 2, 4, \ldots, n-1$; $p_i = i - 1$ and $c_i =$ `+` for $i = 3, 5, \ldots, n$.
5. (20 points) $|\{k : p_k = i\}| \leq 1$ for $i = 2, 3, \ldots, n$.
6. (10 points) No additional constraints.

If you find out the maximum gold the HallowLive squad can earn correctly, but failed to construct a valid plan that yields that amount of gold, you can still get 60% points by printing any valid plan (e.g. `1 2 3 ...` n).

No.	Testdata Range	Time Limit (ms)	Memory Limit (KiB)
Samples	1-3	1000	262144
1	4-12	1000	262144
2	4-20	1000	262144
3	21-24	1000	262144
4	25-28	1000	262144
5	21-35	1000	262144
6	1-40	1000	262144

Samples

Sample Input 1

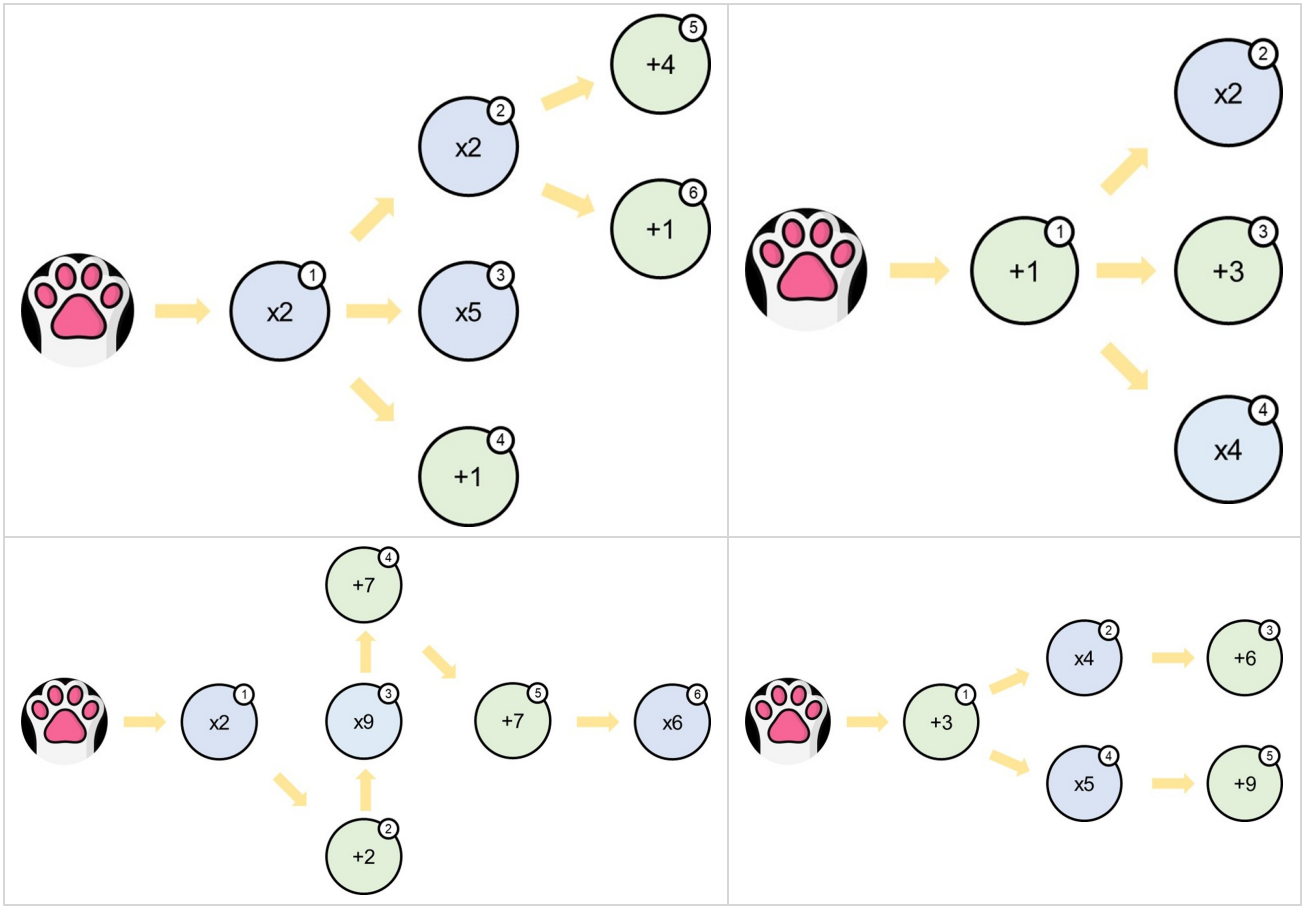
```
4
6
0 1 1 1 2 2
x 2
x 2
x 5
+ 1
+ 4
+ 1
4
0 1 1 1
+ 1
x 2
+ 3
x 4
6
0 1 2 3 4 5
x 2
+ 2
x 9
+ 7
+ 7
x 6
5
0 1 2 1 4
+ 3
x 4
+ 6
x 5
+ 9
```

This sample input satisfies the constraints of Subtasks 1, 2, 6.

Sample Output 1

```
55
1 4 2 5 6 3
40
1 3 2 4
300
1 2 3 4 5 6
122
1 4 5 2 3
```

The four testcases in Sample Input 1 are illustrated below:



Sample Input 2

```
1
19
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
x 9
```

This sample input satisfies the constraints of Subtasks 5, 6.

Sample Output 2

```
infinite
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
```

Sample Input 3

```
1
5
0 1 1 2 3
x 1
+ 1
+ 1
x 2
x 2
```

This sample input satisfies the constraints of Subtasks 1, 2, 5, 6.

Sample Output 3

```
12
1 2 3 4 5
```