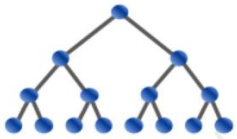


USACO 2026 FIRST CONTEST, SILVER
PROBLEM 1. LINEUP QUERIES

Not submitted yet

English (en)

There is a line of cows, initially (i.e. at time $t = 0$) containing only cow 0 at position 0 (here, a cow is at position k if there are k cows in front of it). At time t for $t = 1, 2, 3, \ldots$, the cow at position 0 moves to position $\lfloor t/2 \rfloor$, every cow in positions $1 \ldots \lfloor t/2 \rfloor$ moves forward one position, and cow t joins the line at the end of the line (position t).

Answer Q ($1 \le Q \le 10^5$) independent queries, each of one of the following types:

1. At what position is cow c immediately after time t ($0 \le c \le t \le 10^{18}$)?
2. Which cow is at position x immediately after time t ($0 \le x \le t \le 10^{18}$)?

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains Q, the number of queries.

The next Q lines each contain three integers specifying a query either of the form "1 c t" or "2 x t."

OUTPUT FORMAT (print output to the terminal / stdout):

Output the answer to each query on a separate line.

SAMPLE INPUT:

```
2
1 4 9
2 2 9
```

SAMPLE OUTPUT:

```
2
4
```

Lineups immediately after various times:

```
t = 0 | 0
t = 1 | 0 1
t = 2 | 1 0 2
t = 3 | 0 1 2 3
t = 4 | 1 2 0 3 4
t = 5 | 2 0 1 3 4 5
t = 6 | 0 1 3 2 4 5 6
t = 7 | 1 3 2 0 4 5 6 7
t = 8 | 3 2 0 4 1 5 6 7 8
t = 9 | 2 0 4 1 3 5 6 7 8 9
```

Immediately after $t = 9$, the location of cow 4 is 2, and the cow located at position 2 is 4.

SAMPLE INPUT:

```
22
1 0 9
1 1 9
1 2 9
1 3 9
1 4 9
1 5 9
1 6 9
1 7 9
1 8 9
1 9 9
2 0 9
2 1 9
2 2 9
2 3 9
2 4 9
2 5 9
2 6 9
2 7 9
2 8 9
2 9 9
1 0 1000000000000000000
2 0 1000000000000000000
```

SAMPLE OUTPUT:

```
1
3
0
4
2
5
6
7
8
9
2
0
4
1
3
5
6
7
8
9
483992463350322770
148148148148148148
```

SCORING:

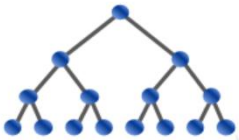
- Input 3: $Q \leq 1000, t \leq 100$
- Input 4: $t \leq 5000$
- Inputs 5-8: All queries are of type 1.
- Inputs 9-12: All queries are of type 2.

Problem credits: Agastya Goel

Language: C

Source File: 选择文件 未选择任何文件

Submit Solution



USACO 2026 FIRST CONTEST, SILVER
PROBLEM 2. MOOCLEAR REACTOR

Not submitted yet

English (en)

Bessie is designing a nuclear reactor to power Farmer John's lucrative new AI data center business, CowWeave!

The reactor core consists of N ($1 \le N \le 2 \cdot 10^5$) fuel rods, numbered 1 through N. The i-th rod has a "stable operating range" $[l_i, r_i]$ ($-10^9 \le l_i \le r_i \le 10^9$), meaning it can only generate power if its energy a_i (chosen by Bessie) satisfies $l_i \le a_i \le r_i$; otherwise, it sits idle and does not generate power. Moreover, a_i must always be an integer. **Note that a_i can be any integer, not limited to $[-10^9, 10^9]$.**

However, quantum interactions between the rods mean that there are M constraints of the form (x, y, z) where Bessie must satisfy $a_x + a_y = z$ ($1 \le x, y \le N$ and $-10^9 \le z \le 10^9$) to prevent the reactor from melting down.

Help Bessie find the maximum number of power-generating rods she can achieve in her design without it melting down!

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains T ($1 \le T \le 10$), the number of independent tests. Each test is specified in the following format:

- The first line contains the two integers N and M.
- The second line contains the N integers $l_1, \ldots, l_N$.
- The third line contains the N integers $r_1, \ldots, r_N$.
- The next M lines each contain three integers x, y, and z, each representing a constraint.

It is guaranteed that neither the sum of N nor the sum of M over all tests exceeds $4 \cdot 10^5$.

OUTPUT FORMAT (print output to the terminal / stdout):

If no choice of rod energies exists that satisfies all constraints, output -1. Otherwise, output the maximum number of power-generating rods Bessie can achieve.

SAMPLE INPUT:

```
2
3 3
1 2 3
1 2 3
1 1 2
2 2 10
1 1 4
3 2
1 2 3
1 2 3
1 1 2
2 2 10
```

SAMPLE OUTPUT:

```
-1
2
```

In the second test, the constraints require that:

1. $a_1 + a_1 = 2$
2. $a_2 + a_2 = 10$

Choosing energies $a = [1, 5, 3]$ results in 2 power-generating rods because:

- $l_1 = 1 \le a_1 \le 1 = r_1$
- $l_3 = 3 \le a_3 \le 3 = r_3$

and a satisfies all required constraints.

SAMPLE INPUT:

```
1
3 2
10 -10 10
10 -10 10
1 2 0
2 3 0
```

SAMPLE OUTPUT:

```
3
```

Choosing rod energies $a = [10, -10, 10]$ results in 3 power-generating rods.

SAMPLE INPUT:

```
5
3 3
1 -1 0
2 1 2
1 2 1
1 3 4
2 3 3
1 1
-100
100
1 1 3
1 1
-100
100
1 1 2
1 2
-100
100
1 1 2
1 1 4
1 2
-100
100
1 1 2
1 1 2
```

SAMPLE OUTPUT:

```
2
-1
1
-1
1
```

SCORING:

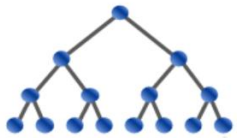
- Input 4: $x = y$ for all constraints.
- Inputs 5-7: $|x - y| = 1$ for all constraints.
- Inputs 8-10: $|x - y| \leq 1$ for all constraints.
- Inputs 11-13: No additional conditions.

Problem credits: Akshaj Arora

Language: C

Source File: 选择文件 未选择任何文件

Submit Solution



USACO 2026 FIRST CONTEST, SILVER
PROBLEM 3. SLIDING WINDOW SUMMATION

Not submitted yet

English (en)

Bessie has a hidden binary string $b_1b_2\dots b_N$ ($1 \le N \le 2 \cdot 10^5$). The only information about b you are given is a binary string $r_1r_2\dots r_{N-K+1}$ ($1 \le K \le N$), where r_i is the remainder when the number of ones in the length-K window of b with leftmost index i is divided by two.

Output the minimum and maximum possible numbers of ones in Bessie's hidden binary string.

INPUT FORMAT (input arrives from the terminal / stdin):

There are T ($1 \le T \le 10^3$) independent test cases to be solved. Each test is specified by the following:

The first line contains N and K.

The second line contains the binary string $r_1 \dots r_{N-K+1}$ where $r_i = \sum_{j=i}^{j+K-1} b_j \pmod 2$.

It is guaranteed that the sum of N over all tests does not exceed 10^6.

OUTPUT FORMAT (print output to the terminal / stdout):

For each test case, output the minimum and maximum possible numbers of ones in Bessie's hidden binary string, separated by a single space.

SAMPLE INPUT:

```
7
5 1
10011
5 2
1001
5 3
100
5 5
0
5 5
1
4 4
1
5 2
0000
```

SAMPLE OUTPUT:

```
3 3
2 3
1 4
0 4
1 5
1 3
0 5
```

For the first test case, $K = 1$ means that $r = b$, and the number of ones in r is 3.

For the second test case, there are two possibilities for b: 10001 and 01110, having 2 and 3 ones, respectively.

SCORING:

- Input 2: $N \le 8$
- Inputs 3-4: $K \le 8$ and the sum of N over all tests does not exceed 10^4.
- Inputs 5-11: No additional constraints.

Problem credits: Benjamin Qi

Language: C

Source File: 选择文件 未选择任何文件

Submit Solution