# Sherlock and Cost

by darkshadows



Русский \| 中文

Array $A$ contains the elements, $A_1, A_2 ... A_N$. And array $B$ contains the elements, $B_1, B_2 ... B_N$. There is a relationship between $A_i$ and $B_i$, $\forall$ $1 \le i \le N$, i.e., any element $A_i$ lies between $1$ and $B_i$.

Let the cost $S$ of an array $A$ be defined as:

$$S = \sum_{i=2}^{N} |A_i - A_{i-1}|$$

You have to print the largest possible value of $S$.

**Input Format**

The first line contains, $T$, the number of test cases. Each test case contains an integer, $N$, in first line. The second line of each test case contains $N$ integers that denote the array $B$.

**Constraints**

$1 \le T \le 20$
$1 \le N \le 10^5$
$1 \le B_i \le 100$

**Output Format**

For each test case, print the required answer in one line.

**Sample Input**

```
1
5
10 1 10 1 10
```

**Sample Output**

```
36
```

**Explanation**

The maximum value occurs when $A_1=A_3=A_5=10$ and $A_2=A_4=1$.



Submissions: 3655
Max Score: 50
Difficulty: Medium

Rate This Challenge:

* Optimal choice of $A_i$ is $1$ or $B_i$

<u>Proof</u>:

Suppose we choose $A_0, A_1, \ldots, A_{n-1}$ s.t.

$$1 \le A_i \le B_i$$

We have:

$$S = |A_1 - A_0| + \cdots + |A_{i+1} - A_i| + |A_{i+2} - A_{i+1}| + \cdots + |A_{n-1} - A_{n-2}|$$

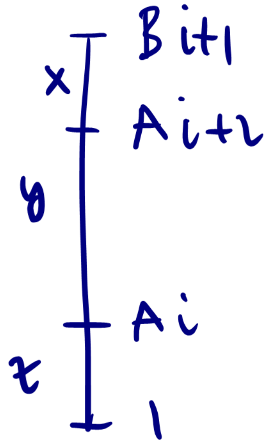
We will focus on how to increase $S$ just by changing $A_{i+1}$:

$$S = S' + |A_i - A_{i+1}| + |A_{i+2} - A_{i+1}|$$

By changing $A_{i+1}$ we don't change $S'$

Without loss of generality suppose:

$$1 < A_i < A_{i+2} < B_{i+1}$$




Suppose we choose:

$A_i < A_{i+1} < A_{i+2}$

Then $S' = A_{i+2} - A_{i+1} +$

$+ A_{i+1} - A_i = y$

Now let $A_{i+1} = B_{i+1}$

In that case:

$$S' = B_{i+1} - A_{i+2} + B_{i+1} - A_i =$$

$$= x + x + y = 2x + y > y$$

Now let $A_{i+1} = 1$

In that case:

$$S' = A_{i+2} - 1 + A_i - 1 =$$

$$= y + z + z = y + 2z > y$$

In both cases we increased $S$, so values $B_i$ or $1$ are always more optimal than any other value. $\square$

$$S(k,1) = \max \begin{cases} S(k-1,1) + |1-1| \\ S(k-1, B_{k-1}) + |1 - B_{k-1}| \end{cases}$$

$$= \max \begin{cases} S(k-1,1) \\ S(k-1, B_{k-1}) + |1 - B_{k-1}| \end{cases}$$

$$S(k, B_k) = \max \begin{cases} S(k-1,1) + |B_k - 1| \\ S(k-1, B_{k-1}) + |B_k - B_{k-1}| \end{cases}$$

$k = 2, 3, \dots, n-1$

$$S(n-1) = \max \begin{cases} S(n-1, 1) \\ S(n-1, B_{n-1}) \end{cases}$$

boundary condition:

$k=2$

$$S(2,1) = \max \begin{cases} S(1,1) \\ S(1, B_1) + |1 - B_1| \end{cases}$$

$$S(2, B_2) = \max \begin{cases} S(1,1) + |B_2 - 1| \\ S(1, B_1) + |B_2 - B_1| \end{cases}$$

I.C.: $$\boxed{\begin{aligned} S(1,1) &= |1 - B_0| \\ S(1, B_1) &= \max \begin{cases} |B_1 - 1| \\ |B_1 - B_0| \end{cases} \end{aligned}}$$