Kick Start 2020 - Round F

Analysis: ATM Queue

Firstly, denote K_i as the number of times a person will use the ATM. Formally, $K_i = \lceil \mathbf{A_i} / \mathbf{X} \rceil$.

Test Set 1

We can directly simulate the process using a queue.

Assume that i-th person, that wants to withdraw $\mathbf{A_i}$, is first in the queue. There are two possibilites:

- $\mathbf{A_i} \le \mathbf{X}$. In that case, this person withdraws $\mathbf{A_i}$ and leaves the queue. We can add i to the answer.
- $\mathbf{A_i} > \mathbf{X}$. In that case, this person withdraws $\mathbf{X}$ (thus setting $\mathbf{A_i}$ to $\mathbf{A_i}$ - $\mathbf{X}$) and goes back to the end of the queue.

Time complexity of this simulation is $O(\Sigma K_i)$.

In the worst case, when $\mathbf{X} = 1$, $K_i = \mathbf{A_i}$. Since $\mathbf{A_i} \le 100$, the worst time complexity is $O(\mathbf{N} \times 100)$, which easily fits into the time limit.

Test Set 2

In the second test set, K_i can be as big as 10^9, so direct simulation is too slow.

Let's look at two people i and j. When will i-th person leave the queue before j-th person? There are two cases:

- $K_i < K_j$. Since i-th person will use the ATM fewer times than j-th person, they will leave the queue earlier.
- $K_i = K_j$ and $i < j$. If they both use the ATM the same amount of times, the person earlier in the queue in the initial configuration will leave first.

This observation is enough to form a full solution. Sort people first in ascending order of K_i, and in case of ties in ascending order of their number. After sorting, this is our answer.

Time complexity of this solution is $O(\mathbf{N} \log \mathbf{N})$.