Kick Start 2022 - Round G

Analysis: Walktober

Test Set 1

We are given the daily steps count of only two people -- John, and another participant. To make sure that John had the maximum steps on each day, we just need to compare his steps on each day with the other participant's steps on that day. Let us maintain a count C of the steps John needs in order to achieve his goal. Before day 1, C is equal to 0. Then, for each day from the beginning of Walktober:

- If John's steps were less than those of the other participant, we add the difference between their steps to C as that is the number of additional steps John needed.
- If John's steps were greater than or equal to those of the other participant, we continue to the next day as John already had the maximum steps for that day.

After the above process, we end up with the total number of steps John required last year in variable C.

Time and Space Complexity: Iterating over all the days would take $O(\mathbf{N})$ time. Overall time taken would be of the order of $O(\mathbf{N})$, with $O(1)$ extra space.

Test Set 2

To help visualize the input, let us make a 2D grid of each person's steps count:

ID	**Day** 1	**Day** 2	$\cdots$	**Day** $\mathbf{N}$
1	$\mathbf{S_{1,1}}$	$\mathbf{S_{1,2}}$	$\cdots$	$\mathbf{S_{1,N}}$
2	$\mathbf{S_{2,1}}$	$\mathbf{S_{2,2}}$	$\cdots$	$\mathbf{S_{2,N}}$
$\cdots\cdots$	$\cdots$	$\cdots$	$\cdots\cdots$	
$\mathbf{M}$	$\mathbf{S_{M,1}}$	$\mathbf{S_{M,2}}$	$\cdots$	$\mathbf{S_{M,N}}$

To calculate the answer, we first need to calculate the maximum steps taken by a participant each day. This would simply be the maximum step count over all $\mathbf{M}$ participants in that day's column in the table above. Let us denote this value for day j with $maxOfDay(j)$, where $1 \leq j \leq \mathbf{N}$. $maxOfDay(j)$ can be calculated by traversing the day column j and keeping a track of the maximum steps encountered so far.

$$maxOfDay(j) = max(\mathbf{S_{1,j}}, \mathbf{S_{2,j}}, \ldots, \mathbf{S_{M,j}})$$

Again, we maintain a count C of the number of steps John would have needed to achieve his goal, starting with $C = 0$. Recall from the statement that $\mathbf{P}$ denotes John's ID. For day j, John would require C_j additional steps, where:

$$C_j = (maxOfDay(j) - \mathbf{S_{P,j}})$$

The total number of steps John required to achieve his goal (and therefore, the answer) would then be:

$$C = (C_1 + C_2 + \cdots + C_{\mathbf{N}})$$

Time and Space Complexity: $maxOfDay()$ runs in $O(\mathbf{M})$ time to find the maximum steps over $\mathbf{M}$ participants on a particular day. Calculating $maxOfDay(j)$ for each j such that $1 \leq j \leq \mathbf{N}$ would take $O(\mathbf{M} \cdot \mathbf{N})$ time. Overall time taken would be of the order of $O(\mathbf{M} \cdot \mathbf{N})$, with $O(\mathbf{N})$ extra space to calculate and store $C_1, C_2, \ldots, C_{\mathbf{N}}$.