Kick Start 2021 - Round F

Analysis: Trash Bins

For every house, we have to find the closest house with a trash bin. This can either be the same house, or some other house to its left or right as at least one house has a trash bin in front of it.

Let $F(i)$ denote distance that the i-th house owner has to walk to take their trashes out. The final answer is $\sum_{i=1}^{\mathbf{N}} F(i)$.

Test Set 1

For i-th house, we find $F(i)$ by iterating over all the houses and picking the house j such that $\mathbf{S}_j = 1$ and the distance between the house i and j is least.

Complexity : $O(\mathbf{N}^2)$ *per test case*

Test Set 2

For i-th house, let $L(i)$ denote the closest house to its left which has trash bin in front of it and $R(i)$ denote the closest house to its right with a trash bin in front of it. We can find $L(i)$ and $R(i)$ for all the houses in one linear pass.

$$L(i) = \begin{cases} -\infty & \text{if } i = 1 \\ i - 1 & \text{if } i > 1 \text{ and } \mathbf{S}_{i-1} = 1 \\ L(i-1) & \text{if } i > 1 \text{ and } \mathbf{S}_{i-1} = 0 \end{cases}$$

$$R(i) = \begin{cases} \infty & \text{if } i = \mathbf{N} \\ i + 1 & \text{if } i < \mathbf{N} \text{ and } \mathbf{S}_{i+1} = 1 \\ R(i+1) & \text{if } i < \mathbf{N} \text{ and } \mathbf{S}_{i+1} = 0 \end{cases}$$

$$F(i) = \begin{cases} 0 & \text{if } \mathbf{S}_i = 1 \\ \min(i - L(i), R(i) - i) & \text{if } \mathbf{S}_i = 0 \end{cases}$$

You might have to deal with overflow issues depending on the data types used as the maximum value of answer does not fit 32-bit integer data types.

You can take ∞ as any value $>= 2 \times \mathbf{N}$.

Complexity : $O(\mathbf{N})$ *per test case*