



PROBLEM SOLVING

Max Population Village

By

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Problem Statement

Given a village and the information on birth & death years of its residents.

You need to find out the maximum population the village has witnessed at any time.

Birth	1900	1910	1980	$\rightarrow B$
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Death	1950	2000	2010	$\rightarrow D$
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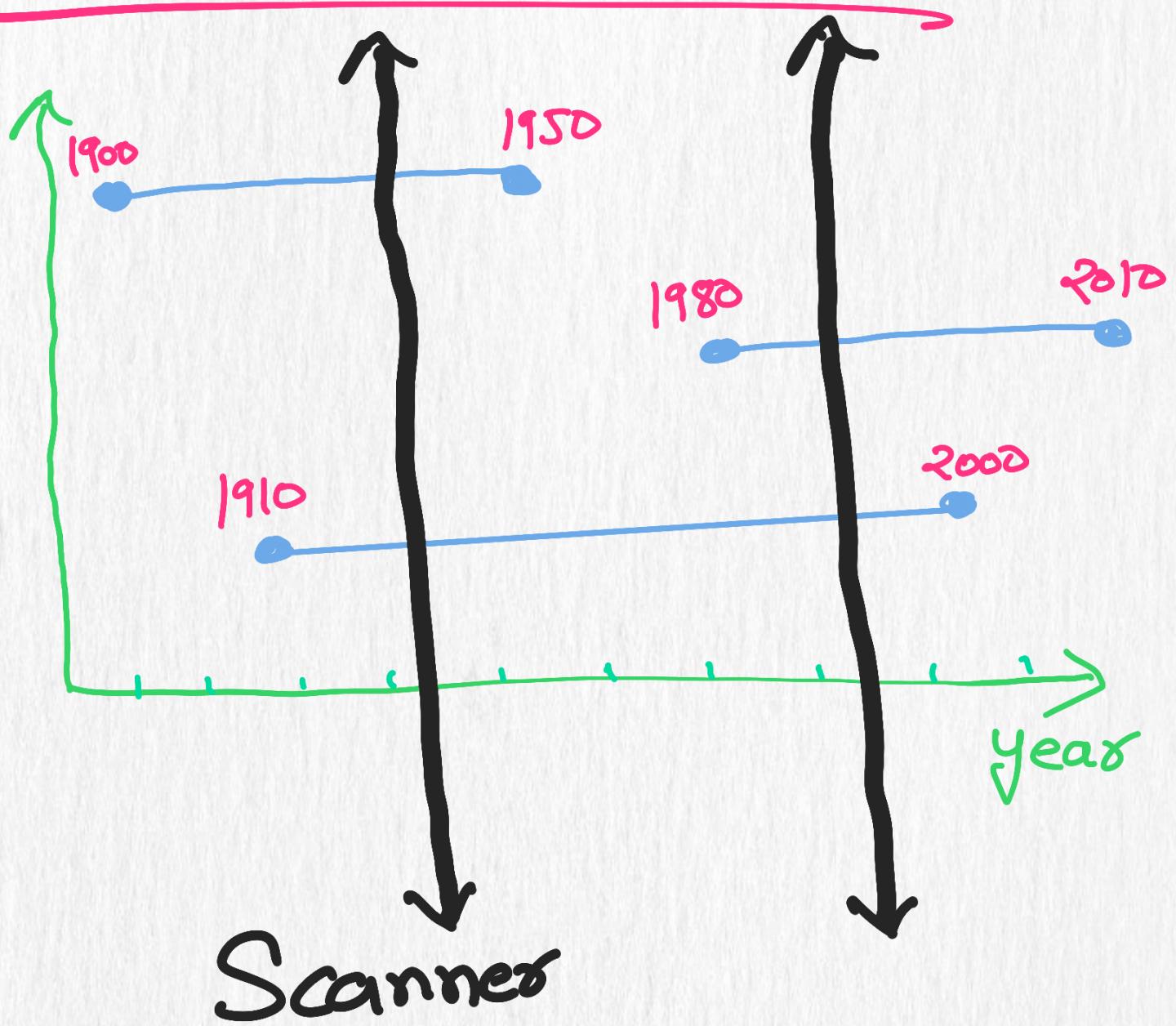
$B_i \leq D_i$ for any i^{th} person

~~Off~~ $\rightarrow 2$

Some Analysis On Problem

- All the data is nothing but years i.e. same unit.
- $B_i \leq D_i$ always
- Birth of person contributes to the population at that time by $+1$ & Death by -1
- We can think better if we can visualize the data

Visualize Data



- The data of all 3 persons are plotted on this graph.
- If we start scanning the population from beginning of time

i.e. 1900 till 2010, we find the max population be

② and it happened in multiple years/ranges as shown by BLACK Scanned line in graph.

→ So this natural logic of our mind we should put in the algorithm.

→ Also, when we move the Scanned line, we get the birth & death events.

→ With any birth event we can add 1 to current population & for death event we can subtract.

→ Also, for any birth/death event we are not interested to know the death/birth of the same person.

Eg. If person died, we do not need to know it's birth year, similarly vice-versa.

→ It also means that
Birth & Death arrays
are independent.

→ Now we have done
good amount of deep
diverse analysis on
this problem & ready
to write the algorithm.

Algorithm

Given Birth [| | |] \rightarrow pointer i
Death [| | | |] \rightarrow pointer j
Cur-pop [0]
max-pop [0]

- ① Sort Birth & Death []
- ② Now we need to traverse the years in increasing order combining from both arrays. We will use pointers i and j on arrays

③ while traversing both arrays with pointers, we need to pick the minimum year from both arrays

→ If year is birth year,

$$\text{cur-pop} + = 1$$

→ If year is death year,

$$\text{cur-pop} - = 1$$

→ Also keep track of max

$$\text{max-pop} = \text{MAX} \left[\begin{matrix} \text{max-pop}, \\ \text{cur-pop} \end{matrix} \right]$$

④ When you are done traversal, max-pop is correct answer.

Time Complexity

Sorting $\rightarrow O(N \lg N)$

Traversal $\rightarrow O(N)$

Overall $\rightarrow O(N \lg N)$

Space Complexity

Variables $\rightarrow O(1)$

Overall $\rightarrow O(1)$

PROBLEM IS
SOLVED



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