

The second line of every test case contains n integers  $b_1, b_2, \dots, b_n$  ( $0 \leq b_i \leq 10^9$ ).

Output

For every test case, if there exist two non-intersecting subarrays in a that have the same sum, output YES on a separate line. Otherwise, output NO on a separate line.

Also, note that each letter can be in any case.

soln->tutorial

We claim the answer is NO if and only if the elements are pairwise distinct.

If any element has two occurrences, we can trivially select them as the two subarrays. Otherwise, since all elements are distinct, choosing a subarray is the same as choosing the set bits of a  $10^9$

digit long binary number. Since every number has a unique binary representation, no two subarrays can have the same sum.

with image



Thought for 1m 28s >

Think of this as a “powers of two + binary representation” problem.

## 1. What the problem is really asking

You build

$$a_i = 2^{b_i}.$$

You must check whether there exist **two disjoint subarrays** with the same sum.

So we want

$$\sum_{k=l_1}^{r_1} 2^{b_k} = \sum_{k=l_2}^{r_2} 2^{b_k}, \quad 1 \leq l_1 \leq r_1 < l_2 \leq r_2 \leq n.$$

## 2. If any $b$ repeats → answer YES

If some value occurs at least twice, say  $b_i = b_j$  with  $i < j$ ,

- then  $a_i = 2^{b_i} = 2^{b_j} = a_j$ ,
- take subarrays  $[i, i]$  and  $[j, j]$ .

They are non-intersecting, and their sums are both  $a_i$ .

So Valerii is wrong → **print YES**.

So from now on, assume all  $b_i$  are **pairwise distinct**.

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### 3. Key fact about powers of two

Because all  $b_i$  are different, all  $a_i = 2^{b_i}$  are different powers of two.

Any non-empty subset of distinct powers of two has a **unique sum**.

Why?

Let a subset have exponents  $X = \{x_1, x_2, \dots\}$ .

Let  $m = \max X$ . Then

$$\sum_{x \in X} 2^x \geq 2^m,$$

while the sum of *all* smaller powers of two is

$$\sum_{i=0}^{m-1} 2^i = 2^m - 1.$$

This is exactly the equation written at the bottom of your slide:

$$\sum_{i=0}^{n-1} 2^i = 2^n - 1.$$

So the side that contains  $2^m$  is **strictly larger** than any sum of powers that only use exponents  $< m$ .

That means two different subsets of exponents **cannot** have the same sum.

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### 4. Apply this to subarrays

Take any two **non-intersecting** subarrays:

- first: indices  $i \dots j$ ,
- second: indices  $p \dots q$ , with  $j < p$ .

Their elements are:

$$S_1 = \{b_i, b_{i+1}, \dots, b_j\}, \quad S_2 = \{b_p, b_{p+1}, \dots, b_q\}.$$

Because the indices don't overlap and every  $b$  is distinct, the **exponent sets**  $S_1$  and  $S_2$  are disjoint.

The equality of sums

$$\sum_{k=i}^j 2^{b_k} = \sum_{k=p}^q 2^{b_k}$$

is exactly:

$$\sum_{x \in S_1} 2^x = \sum_{x \in S_2} 2^x,$$

i.e. *two different subsets of distinct powers of two have the same sum*, which we just proved is impossible.

This is what the first slide's formula is saying:

$$\sum_{k=i}^j 2^{B_k} \neq \sum_{x \in X} 2^x \quad \forall X \subset (Z \setminus \{B_i, \dots, B_j\}),$$

where

- $Z$  is the set of all exponents  $\{b_1, \dots, b_n\}$ ,
- $\{B_i, \dots, B_j\}$  is the chosen subarray,
- $X$  is *any* subset of the remaining exponents.

So one block's sum can't equal any sum using the other exponents, including another disjoint subarray.

Hence, **if all  $b_i$  are distinct, no two disjoint subarrays can have the same sum.**

Valerii is correct → we **print NO**.

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## 5. Final logic for each test case

- If some  $b_i$  appears at least twice → **YES**.
- Else (all  $b_i$  pairwise distinct) → **NO**.

That's exactly the statement:

“The answer is NO if and only if the elements are pairwise distinct.”

The pictures you attached are just visualizing:

- the array with a chosen subarray  $[A_i, \dots, A_j]$ ,
- the fact that its sum (sum of some powers of two) can't equal the sum of any subset of the others,

- and the key inequality  $\sum_{k=0}^{n-1} 2^k = 2^n - 1$  used to prove uniqueness of representation.

