# Problem G. Palindromic Differences

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 2 seconds |
| Memory limit: | 256 megabytes |

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For an array $a = [a_1, a_2, \ldots, a_n]$, $n \geq 2$, its *difference array* is defined as $[a_2 - a_1, a_3 - a_2, \ldots, a_n - a_{n-1}]$.

The array $a = [a_1, a_2, \ldots, a_n]$ is a *palindrome* if it doesn't change after being reversed.

A permutation of array $a$ is an array which has the same elements as $a$, but possibly in a different order.

You are given an array $a$ of length $n$. Find the number of distinct permutations of $a$ whose difference array is a palindrome. Two arrays $a$ and $b$ of same length are distinct if and only if for some $i$, $a_i \neq b_i$.

As this number can be very large, print it modulo $10^9 + 9$.

## Input

Each test contains multiple test cases. The first line contains the number of test cases $t$ ($1 \leq t \leq 100$). The description of the test cases follows.

The first line of each test case contains an integer $n$ ($2 \leq n \leq 5 \cdot 10^5$) — the length of the array $a$.

The second line of each test case contains $n$ integers $a_1, a_2, \ldots a_n$ ($-10^9 \leq a_i \leq 10^9$).

It is guaranteed that the sum of $n$ over all test cases does not exceed $5 \cdot 10^5$.

## Output

For each test case, print a single number on a separate line — the answer to the test case modulo $10^9 + 9$.

## Example

| standard input | standard output |
|---|---|
| 5<br>3<br>2 3 1<br>4<br>1 1 1 1<br>3<br>1 2 4<br>7<br>0 200 0 200 50 100 150<br>14<br>-1 0 1 2 3 4 5 6 7 8 9 10 11 12 | 2<br>1<br>0<br>24<br>645120 |

## Note

In the first test case, the array $[2, 3, 1]$ has six permutations: $[1, 2, 3]$, $[1, 3, 2]$, $[2, 1, 3]$, $[2, 3, 1]$, $[3, 1, 2]$, $[3, 2, 1]$. Their difference arrays are $[1, 1]$, $[2, -1]$, $[-1, 2]$, $[1, -2]$, $[-2, 1]$, $[-1, -1]$. Of them only two are palindromes: $[1, 1], [-1, -1]$. So, the only two permutations with palindromic difference arrays are $[1, 2, 3]$ and $[3, 2, 1]$.

In the second test case, there is only one permutation $[1, 1, 1, 1]$. Its difference array $[0, 0, 0]$ is a palindrome.

In the third test case, none of permutations has a palindromic difference array.