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Roy and alpha-beta trees 🔖

by sentinel45

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Russian

Roy has taken a liking to the Binary Search Trees(BST). He is interested in knowing the number of ways an array A of N integers can be arranged to form a BST. Thus, he tries a few combinations, and notes down the numbers at the odd levels and the numbers at the even levels.

You're given two values, *alpha* and *beta*. Can you calculate the sum of *Liking* of all possible *BST's* that can be formed from an array of N integers? *Liking* of each *BST* is defined as follows

```
(sum of numbers on even levels * alpha) - (sum of numbers on odd levels * beta)
```

Note

- The root element is at level 0 (Even)

- The elements smaller or equal to the parent element are present in the left subtree, elements greater than or equal to the parent element are present in the right subtree. Explained here

If the answer is no less than $10^9 + 9$, output the answer % $10^9 + 9$.

(If the answer is less than 0, keep adding $10^9 + 9$ until the value turns non negative.)

Input Format
The first line of input file contains an integer, T, denoting the number of test cases to follow.
Each testcase comprises of 3 lines.
The first line contains N, the number of integers.
The second line contains two space separated integers, *alpha* and *beta*.
The third line contains space separated N integers_, denoting the ith integer in array $A[i]$.

Output Format
Output T lines. Each line contains the answer to its respective test case.

Constraints

$1 \leq T \leq 10$
$1 \leq N \leq 150$
$1 \leq A[i] \leq 10^9$
$1 \leq alpha, beta \leq 10^9$

Sample Input

```
4
1
1 1
1
2
1 1
1 2
3
1 1
```

```
1 2 3
5
1 1
1 2 3 4 5
```
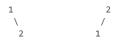
Sample Output

```
1
0
6
54
```

Explanation

There are 4 test cases in total.

- For the first test case, only 1 BST can be formed with 1 as the root node. Hence the *Liking* / sum is 1.

- For the second test case, we get 2 BSTs of the form, the *Liking* of the first tree is $1 * 1 - 2 * 1 = -1$ and $2 * 1 - 1 * 1 = 1$, this sums to 0, hence the answer.

```
1                    2
 \                  /
  2                1
```

- For the third test case, we get 5 BSTs. The *Liking* of each of the BST from left to right are $2, -2, 4, 2, 0$ which sums to 6 and hence the answer.

```
1            2              3          3        1
 \          / \            /          /          \
  2        1   3          1          2            3
   \                       \          /           /
    3                       2        1           2
```

- Similarly, for the fourth test case, the answer is 54.

Current Buffer (saved locally, editable)   Java 7

```java
1  import java.io.*;
2  import java.util.*;
3  import java.text.*;
4  import java.math.*;
5  import java.util.regex.*;
6
7  public class Solution {
8
9      public static void main(String[] args) {
10         /* Enter your code here. Read input from STDIN. Print output to STDOUT. Your class should be named Solution. */
11     }
12 }
```

Line: 1 Col: 1

Run Code   Submit Code

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