Maximum Subarray Sum

by devuy11

We define the following:

- A *subarray* of an n-element array, A, is a contiguous subset of A's elements in the inclusive range from some index i to some index j where $0 \leq i \leq j < n$.
- The *sum* of an array is the sum of its elements.

Given an n-element array of integers, A, and an integer, m, determine the maximum value of the sum of any of its subarrays modulo m. This means that you must find the sum of each subarray modulo m, then print the maximum result of this modulo operation for any of the $\frac{n \cdot (n+1)}{2}$ possible subarrays.

Input Format

The first line contains an integer, q, denoting the number of queries to perform. Each query is described over two lines:

1. The first line contains two space-separated integers describing the respective n (the array length) and m (the right operand for the modulo operations) values for the query.
2. The second line contains n space-separated integers describing the respective elements of array $A = a_0, a_1, \ldots, a_{n-1}$ for that query.

Constraints

- $2 \leq n \leq 10^5$
- $1 \leq m \leq 10^{14}$
- $1 \leq a_i \leq 10^{18}$
- $2 \leq$ the sum of n over all test cases $\leq 5 \times 10^5$

Output Format

For each query, print the maximum value of $subarray\ sum\ \%\ m$ on a new line.

Sample Input

```
1
5 7
3 3 9 9 5
```

Sample Output

```
6
```

Explanation

The subarrays of array $A = [3, 3, 9, 9, 5]$ and their respective sums modulo $m = 7$ are ranked in order of length and sum in the following list:

1. $[9] \Rightarrow 9 \% 7 = 2$ and $[9] \rightarrow 9 \% 7 = 2$
   $[3] \Rightarrow 3 \% 7 = 3$ and $[3] \rightarrow 3 \% 7 = 3$
   $[5] \Rightarrow 5 \% 7 = 5$

2. $[9, 5] \Rightarrow 14 \% 7 = 0$
   $[9, 9] \Rightarrow 18 \% 7 = 4$
   $[3, 9] \Rightarrow 12 \% 7 = 5$
   $[3, 3] \Rightarrow 6 \% 7 = 6$

3. $[3, 9, 9] \Rightarrow 21 \% 7 = 0$
   $[3, 3, 9] \Rightarrow 15 \% 7 = 1$
   $[9, 9, 5] \Rightarrow 23 \% 7 = 2$

4. $[3, 3, 9, 9] \Rightarrow 24 \% 7 = 3$
   $[3, 9, 9, 5] \Rightarrow 26 \% 7 = 5$

5. $[3, 3, 9, 9, 5] \Rightarrow 29 \% 7 = 1$

As you can see, the maximum value for $subarray\ sum \% 7$ for any subarray is 6, so we print 6 on a new line.

Submissions: 15122

Max Score: 65

Difficulty: Hard

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Java 7

```
import java.io.*;
import java.util.*;
import java.text.*;
import java.math.*;
import java.util.regex.*;

public class Solution {

    static long maximumSum(long[] a, long m) {
        // Complete this function
    }

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int q = in.nextInt();
        for(int a0 = 0; a0 < q; a0++){
            int n = in.nextInt();
            long m = in.nextLong();
            long[] a = new long[n];
            for(int a_i = 0; a_i < n; a_i++){
                a[a_i] = in.nextLong();
            }
            long result = maximumSum(a, m);
            System.out.println(result);
        }
        in.close();
    }
}

```

Line: 1 Col: 1

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