Maximum Subarray Sum ☆

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We define the following:

- A subarray of array a of length n is a contiguous segment from $a[i]$ through $a[j]$ 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. For example, Assume $a = [1, 2, 3]$ and $m = 2$. The following table lists all subarrays and their moduli:

	sum	%2
[1]	1	1
[2]	2	0
[3]	3	1
[1,2]	3	1
[2,3]	5	1
[1,2,3]	6	0

The maximum modulus is 1.

Function Description

Complete the maximumSum function in the editor below. It should return a long integer that represents the maximum value of $subarray\ sum\ \%\ m$.

maximumSum has the following parameter(s):

- a: an array of long integers, the array to analyze
- m: a long integer, the modulo divisor

Input Format

The first line contains an integer q, the number of queries to perform.

The next q pairs of lines are as follows:

- The first line contains two space-separated integers n and (long)m, the length of a and the modulo divisor.
- The second line contains n space-separated long integers $a[i]$.

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, return the maximum value of $subarray\ sum\ \%\ m$ as a long integer.

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

The maximum value for $subarray\ sum\ \%\ 7$ for any subarray is 6.

Change Theme C++

```
vector<string> split_string(string);
//https://www.geeksforgeeks.org/maximum-subarray-sum-modulo-m/#:~:text=Given%20an%20array%20of%20n,value%20of%20this%20modulo%20operation.
//EXPLANATION: https://www.youtube.com/watch?v=u_ft5jCDZXk&ab_channel=alGOds
// Complete the maximumSum function below.
long maximumSum(vector<long> a, long m) {
    long n = a.size();
    long prefix = 0, maxim = 0;
    set<long> S;  ///to keep track of all modulo values that have been seen
    S.insert(0);
    // Traversing the array.
    for (long i = 0; i < n; i++)
    {   // Finding prefix sum.
        prefix = (prefix + a[i])%m;  //calculating modulo value till current arr index
        //Note: we don't need to calc prefix-sum aarray first. //https://www.quora.com/What-is-the-logic-used-in-the-HackerRank-Maximise-Sum-problem
        // Finding maximum of prefix sum.
        maxim = max(maxim, prefix);
        // Finding iterator pointing to the first element that is not less than value
        // "prefix + 1", i.e., greater than or equal to this value.
```

```
        auto it = S.lower_bound(prefix+1);  // lower_bound function returns an iterator
to the first element that is greater than or equal to val (prefix+1).
        if (it != S.end())
            maxim = max(maxim, prefix - (*it) + m );
        // Inserting prefix in the set.
        S.insert(prefix);
    }
    return maxim;
}
```

Line: 18 Col: 64

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