



# Maximum Subarray Sum

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Problem

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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 modulus:

	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.

## 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  $m$ , the length of  $a$  and the modulo divisor.
- The second line contains  $n$  space-separated 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, 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**.

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Difficulty: Hard

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Python 3



```
1  #!/bin/python3
2
3  import math
4  import os
5  import random
6  import re
7  import sys
8
9  # Complete the maximumSum function below.
10 def maximumSum(a, m):
11
12  if __name__ == '__main__':
13      fptr = open(os.environ['OUTPUT_PATH'], 'w')
```

```
14
15     q = int(input())
16
17     for q_itr in range(q):
18         nm = input().split()
19
20         n = int(nm[0])
21
22         m = int(nm[1])
23
24         a = list(map(int, input().rstrip().split()))
25
26         result = maximumSum(a, m)
27
28         fptr.write(str(result) + '\n')
29
30     fptr.close()
31
```

Line: 1 Col: 1

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