

## 1 Crazy Walk

Crazyman recently bought a dog and now he wants to train it. He belongs to the school of dog training that uses extreme negative reinforcement via electric shocks. Crazyman believes that over a period of time, the dog will learn to walk in a way so as to minimize negative reinforcement.

Every morning, Crazyman takes his dog for a crazy walk. A crazy walk takes place on a straight sidewalk in Crazytown. This sidewalk is  $N$  metres long from west to east. The only way the dog moves is by making integer length jumps from west to east. Each jump is between 1 and  $L$  metres, inclusive, in length. The crazy walk starts at the west end of the sidewalk, at position 0, and ends when the dog reaches or jumps over the east end of the sidewalk, at position  $N$ .

Crazyman has arranged  $M$  high voltage open electric wires across the sidewalk. Wire  $i$  runs from north to south across the sidewalk, at integer distance  $d_i$  from its western end. The dog has learned from its previous experiences and *never* steps on a high voltage electric wire.

Besides this, Crazyman gives the dog  $s_j$  mild electric shocks after each jump  $j$ , as follows:

- $s_j = 1$  if and only if  $j > 1$  and the length of jump  $j$  equals the length of jump  $j-1$ .
- $s_j = Q$  otherwise, for a fixed  $Q > 1$ . Note that  $s_1 = Q$ , always.

Crazyman hopes that the dog will learn to minimize the total number of mild electric shocks it receives during the walk. Crazyman wants you to find the minimum possible value of this quantity so that he will know when the dog's training is complete. Output  $-1$  if a crazy walk is not possible.

### Input format

- The first line of input contains three space separated integers:  $N$ ,  $L$  and  $Q$ .
- The second line contains a single integer  $M$ .
- The third line consists of  $M$  distinct space separated integers, in ascending order. Integer  $i$  in this list is  $d_i$ , the position of wire  $i$ .

### Output format

Output a single integer, the minimum possible number of mild electric shocks for a crazy walk. If no crazy walk is possible, output  $-1$ .

### Test Data

In all cases,  $1 < Q \leq 10000$ ,  $0 \leq M < N$  and, for each  $i$ ,  $0 < d_i < N$ .

- Subtask 1 (30 marks) :  $1 \leq N \leq 100$ ,  $1 \leq L \leq 100$ .
- Subtask 2 (70 marks) :  $1 \leq N \leq 10000$ ,  $1 \leq L \leq 1000$ .

#### Sample Input 1

```
13 3 10
3
1 2 6
```

#### Sample Output 1

24

#### Sample Input 2

```
13 3 10
3
10 11 12
```

#### Sample Output 2

-1

## Explanation

In the first case, the sequence of jumps of length 3,2,2,2,2,2 leads to a total of  $10+10+1+1+1+1 = 24$  mild electric shocks, which is the minimum possible. In the second case, no crazy walk is possible because the dog cannot jump across the three wires without landing on one of them.

## Limits

- *Time limit:* 2 s
- *Memory limit:* 128 MB