

## CMPUT 274 - Tangible Computing

### Morning Problem: Full Tank

---

#### Description

Bob is planning a road trip, but he's curious how quickly he can arrive at his destination. He will start with a full tank of gas at his home and must drive a distance of  $l$  units. Each unit of distance takes one unit of time to travel.

Once Bob's gas runs out he can no longer drive, so he must refuel before this happens, luckily there are many gas stations along the way. It takes exactly  $t$  units of time to refuel at a gas station, leaving Bob with a full tank of gas! For our purposes, if Bob runs out of fuel while arriving at a gas station, this is okay. Likewise, if he arrives at his destination with no fuel this is considered okay as well, he has already located a gas station at his destination.

There can be a gas station as early as one unit away from Bob's home and as late as one unit from his destination.

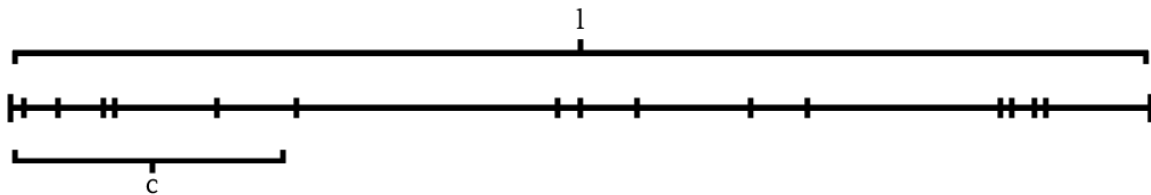


Figure 1: See sample 2.

#### Input

The first line of input will contain four space separated integers,  $1 \leq l \leq 1,000,000$ , the length of the road trip,  $1 \leq c \leq 100,000$ , the capacity of the gas tank,  $0 \leq n \leq 100,000$ , the amount of gas stations along the road trip, and  $0 \leq t \leq 1,000$ , the amount of time it takes to refuel at a gas station (regardless of how much gas is already in the tank).

The next line contains  $n$  space separated integers between 1 and  $l - 1$  each specifying the location of a single gas station.

Note, it is guaranteed that Bob will make it to his destination.

#### Output

Output a single integer, the shortest amount of time the road trip could take provided the gas tank never runs dry.

### Sample Input 1

100 12 9 10
12 23 34 44 56 67 79 89 95

### Sample Output 1

180
-----

### Explanation:

The quickest possible path that Bob could take to arrive at his destination is to refuel at all but the last gas station. This means he refuels 8 times, each taking 10 units of time and travels 100 units in total taking 100 units of time, therefore he took 180 units of time to arrive at his destination.

Note, Bob's tank is dry when arriving to the first gas station, but as noted above this is okay.

### Sample Input 2

100 24 15 5
1 4 8 9 18 25 48 50 55 65 70 87 88 90 91

### Sample Output 2

125
-----

### Explanation:

One path that attains the minimum value has Bob refuel his car at the following locations (18, 25, 48, 65, 88). There are alternate correct stops, but the time taken will be equivalent.