Heirloom Painting

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

Little Desprado2, the great artist, has a small painting robot to do some artistic creations.

Today, he draws a **ring** divided by n grids, and there are m kinds of colors. He wants to paint the ring as he wants. However, because of some technical issues – using a heirloom printer nozzle to save cost, for example – the robot will paint **exactly** k continuous grids with the same color each time. In addition, the strong organic pigment can overlay the previous paintings, which means that the color applied later will **replace** the previous color.

Little Desprado2 wants to know the minimum number of times that his robot should paint from the empty grids to a given pattern, or it's impossible to do so.

Input

The first line contains one integer T ($1 \leq T \leq 10^5$), denoting the number of test cases.

For each test case, the first line contains three integers n, m and k ($1 \leq n, m \leq 10^6, 1 \leq k \leq n$), denoting the number of grids, colors and grids the robot will paint each time, respectively. The second line contains n numbers $c_1,\ c_2,\ ...,\ c_n$ ($1 \leq c_i \leq m$), c_i denotes the color of the i-th grid that little Desprado2 wants.

There are no color at the beginning, and you can consider the uncolored grids with color -1 for simplicity.

It is guaranteed that sum of n over all test cases won't exceed 10^6.

Output

For each test case, print a single integer in a separated line - the minimal times the robot should paint. If the mission is impossible, print -1.

Example

standard input	standard output
3 11 4 2 1 1 1 2 2 3 3 3 4 4 1 5 2 1 1 2 1 2 1 6 2 2 1 2 1 2 1 2	6 5 -1

Note

For the first example, one optimal strategy is:

1. Paint grid 11 and grid 1 in color 1. Note that this is a ring so grid 11 and grid 1 is adjacent.
2. Paint grid 2 and grid 3 in color 1.
3. Paint grid 4 and grid 5 in color 2.
4. Paint grid 6 and grid 7 in color 3.
5. Paint grid 8 and grid 9 in color 3.
6. Paint grid 9 and grid 10 in color 4. Note that the color in 9 is now replaced with 4 from 3.