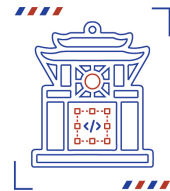




# THE 2024 ICPC ASIA PACIFIC CHAMPIONSHIP

VNU UNIVERSITY OF ENGINEERING AND TECHNOLOGY

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## Problem C Bit Counting Sequence Time limit: 2 seconds

For a non-negative integer  $x$ , let  $p(x)$  be the number of ones in the binary representation of  $x$ . For example,  $p(26) = 3$  because  $26 = (11010)_2$ .

You are given a sequence of  $n$  integers  $(a_1, a_2, \dots, a_n)$ . Your task is to determine whether there exists a non-negative integer  $x$  such that  $(p(x), p(x + 1), \dots, p(x + n - 1))$  is equal to  $(a_1, a_2, \dots, a_n)$ . Furthermore, if it exists, compute the smallest  $x$  satisfying the condition.

### Input

The first line of input contains one integer  $t$  ( $1 \leq t \leq 1000$ ) representing the number of test cases. After that,  $t$  test cases follow. Each of them is presented as follows.

The first line contains one integer  $n$  ( $1 \leq n \leq 500\,000$ ). The second line contains  $n$  integers  $a_1, a_2, \dots, a_n$  ( $0 \leq a_i \leq 60$  for all  $i$ ).

The sum of  $n$  across all test cases in one input file does not exceed 500 000.

### Output

For each test case, output the smallest non-negative integer  $x$  satisfying the condition above. If there is no such  $x$ , output  $-1$  instead.

#### Sample Input #1

#### Sample Output #1

4	13
5	3
3 3 4 1 2	2305843009213693949
3	-1
2 1 2	
2	
60 60	
2	
8 0	

#### Explanation for the sample input/output #1

For the first test case,  $x = 13$  satisfies the condition above since  $(p(13), p(14), p(15), p(16), p(17)) = (3, 3, 4, 1, 2)$ . It can be shown that there is no non-negative integer smaller than 13 that satisfies the condition above.