European Girls'
Olympiad in Informatics
EGOI - 2022
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# SubsetMex

| Problem Name | Subset Mex |
|---|---|
| Input file | standard input |
| Output file | standard output |
| Time limit | 1 second |
| Memory limit | 256 megabytes |

A *multiset* is a collection of elements similar to a set, where elements can repeat multiple times. For example, the following is a multiset:

{0, 0, 1, 2, 2, 5, 5, 5, 8}

Given a multiset $S$ defined on non-negative integers, and a target non-negative integer value $n$ such that $n$ does not belong to $S$, your goal is to insert $n$ into $S$ by using the following 3-step operation, repeatedly:

1. Choose a (possibly empty) subset $T$ of $S$. Here, $T$ is a set of distinct numbers that appear in $S$.

2. Erase elements of $T$ from $S$. (Remove only one copy of each element.)

3. Insert **mex**($T$) into $S$, where **mex**($T$) is the smallest non-negative integer that does not belong to $T$. The name **mex** stands for "minimum excluded" value.

Your goal is to find the minimum number of operations to perform so that $n$ becomes part of $S$.

Since the size of $S$ may be large, it will be given in the form of a list $(f_0, ..., f_{n-1})$ of size $n$, where $f_i$ represents the number of times that the number $i$ appears in $S$. (Recall that $n$ is the integer we are trying to insert into $S$.)

## Input

The first line contains a single integer $t$ ($1 \le t \le 200$) — the number of test cases. Each two of the following lines describe a test case:

- The first line of each test case contains a single integer $n$ ($1 \le n \le 50$), representing the integer to be inserted into $S$.

- The second line of each test case contains $n$ integers $f_0, f_1, \ldots, f_{n-1}$ $(0 \le f_i \le 10^{16})$, representing the multiset $S$ as mentioned above.

# Output

For each test case, print a single line containing the minimum number of operations needed to satisfy the condition.

# Scoring

Subtask #1 (5 points): $n \le 2$

Subtask #2 (17 points): $n \le 20$

Subtask #3 (7 points): $f_i = 0$

Subtask #4 (9 points): $f_i \le 1$

Subtask #5 (20 points): $f_i \le 2000$

Subtask #6 (9 points): $f_0 \le 10^{16}$ and $f_j = 0$ (for all $j \ne 0$)

Subtask #7 (10 points): There exists a value $i$ for which $f_i \le 10^{16}$ and $f_j = 0$ (for all $j \ne i$)

Subtask #8 (23 points): No additional constraints

# Examples

| standard input | standard output |
| --- | --- |
| 2<br>4<br>0 3 0 3<br>5<br>4 1 0 2 0 | 4<br>10 |

# Note

In the first example, initially, $S = \{1, 1, 1, 3, 3, 3\}$ and our goal is to have 4 in $S$. We can do the following:

1. choose $T = \{\}$ then $S$ becomes $\{0, 1, 1, 1, 3, 3, 3\}$

2. choose $T = \{0, 1, 3\}$ then $S$ becomes $\{1, 1, 2, 3, 3\}$

3. choose $T = \{1\}$ then $S$ becomes $\{0, 1, 2, 3, 3\}$

4. choose $T = \{0, 1, 2, 3\}$ then $S$ becomes $\{3, 4\}$