Counting Special Sub-Cubes

HackerRank

Given an $n \times n \times n$ *cube*, let $f(x, y, z)$ (where $1 \leq x, y, z \leq n$) denote the value stored in cell (x, y, z).

A $k \times k \times k$ *sub-cube* (where $1 \leq k \leq n$) of an $n \times n \times n$ cube is considered to be *special* if the maximum value stored in any cell in the sub-cube is equal to k.

For each k in the inclusive range $[1, n]$, calculate the number of special sub-cubes. Then print each $count_k$ as a single line of space-separated integers (i.e., $count_1 \ count_2 \ \ldots \ count_n$).

Input Format

The first line contains an integer, q, denoting the number of queries. The $2 \cdot q$ subsequent lines describe each query over two lines:

1. The first line contains an integer, n, denoting the side length of the initial cube.
2. The second line contains n^3 space-separated integers describing an array of n^3 integers in the form $a_0, a_1, \ldots, a_{n^3-1}$. The integer in some cell (x, y, z) is calculated using the formula $a[(x-1) \cdot n^2 + (y-1) \cdot n + z]$.

Constraints

- $1 \leq q \leq 5$
- $1 \leq n \leq 50$
- $1 \leq f(x, y, z) \leq n$ where $1 \leq x, y, z \leq n$

Output Format

For each query, print n space-separated integers where the i^{th} integer denotes the number of special sub-cubes for $k = i$.

Sample Input

```
2
2
2 1 1 1 1 1 1 1
2
1 1 1 1 2 1 1 2
```

Sample Output

```
7 1
6 1
```

Explanation

We must perform the following $q = 2$ queries:

1. We have a cube of size $n = 2$ and must calculate the number of special sub-cubes for the following values of k:

   - $k = 1$: There are $2^3 = 8$ sub-cubes of size 1 and seven of them have a maximum value of 1 written inside them. So, for $k = 1$, the answer is 7.

   - $k = 2$: There is only one sub-cube of size 2 and the maximum number written inside it is 2. So, for $k = 2$, the answer is 1.

   We then print the respective values for each k as a single line of space-separated integers (i.e., `7 1`).

2. We have a cube of size $n = 2$ and must calculate the number of special sub-cubes for the following values of k:

   - $k = 1$: There are $2^3 = 8$ sub-cubes of size 1 and six of them have a maximum value of 1 written inside them. So, for $k = 1$, the answer is 6.

   - $k = 2$: There is only one sub-cube of size 2 and the maximum number written inside it is 2. So, for $k = 2$, the answer is 1.

   We then print the respective values for each k as a single line of space-separated integers (i.e., `6 1`).