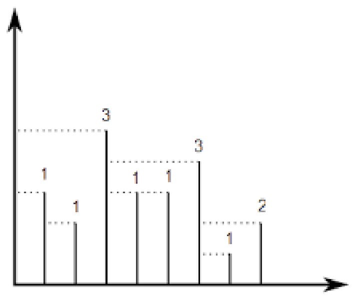
Vertical Sticks

HackerRank

Given an array of integers $Y = [y_1, y_2, \ldots, y_n]$, we have n line segments, such that, the endpoints of i^{th} segment are $(i, 0)$ and (i, y_i). Imagine that from the top of each segment a horizontal ray is shot to the left, and this ray stops when it touches another segment or it hits the y-axis. We construct an array of n integers, $[v_1, v_2, \ldots, v_n]$, where v_i is equal to length of ray shot from the top of segment i. We define $V(y_1, y_2, \ldots, y_n) = v_1 + v_2 + \ldots + v_n$.

For example, if we have $Y = [3, 2, 5, 3, 3, 4, 1, 2]$, then $v_1, v_2, \ldots, v_8 = [1, 1, 3, 1, 1, 3, 1, 2]$, as shown in the picture below:



For each permutation p of $[1, 2, \ldots, n]$, we can calculate $V(y_{p_1}, y_{p_2}, \ldots, y_{p_n})$. If we choose a uniformly random permutation p of $[1, 2, \ldots, n]$, what is the expected value of $V(y_{p_1}, y_{p_2}, \ldots, y_{p_n})$?

Input Format

The first line contains a single integer *T* (1 <=*T*<= 100). *T* test cases follow.
The first line of each test-case is a single integer *N* (1 <= *n* <= 50), and the next line contains positive integer numbers $y_1, y_2 \ldots, y_n$ separated by a single space ($0 < y_i <= 1000$).

Output Format

For each test-case output expected value of $V(y_{p_1}, y_{p_2}, \ldots, y_{p_n})$, rounded to two digits after the decimal point.

Sample Input

```
6
3
1 2 3
3
3 3 3
3
2 2 3
4
10 2 4 4
5
10 10 10 5 10
6
1 2 3 4 5 6
```

Sample Output

```
4.33
3.00
4.00
6.00
5.80
11.15
```

Explanation

Case 1: We have $V(1,2,3) = 1+2+3 = 6, V(1,3,2) = 1+2+1 = 4, V(2,1,3) = 1+1+3 = 5,$ $V(2,3,1) = 1+2+1 = 4, V(3,1,2) = 1+1+2 = 4, V(3,2,1) = 1+1+1 = 3$.
Average of these values is 4.33.
Case 2: No matter what the permutation is, $V(y_{p_1}, y_{p_2}, y_{p_3}) = 1+1+1 = 3$, so the answer is 3.00.
Case 3: $V(y_1, y_2, y_3) = V(y_2, y_1, y_3) = 5$,
$V(y_1, y_3, y_2) = V(y_2, y_3, y_1) = 4$,
$V(y_3, y_1, y_2) = V(y_3, y_2, y_1) = 3$,
and average of these values is 4.00.