Day 1: Interquartile Range

HackerRank

Objective
In this challenge, we practice calculating the *interquartile range*. We recommend you complete the Quartiles challenge before attempting this problem.

Task
The interquartile range of an array is the difference between its first (Q_1) and third (Q_3) quartiles (i.e., $Q_3 - Q_1$).

Given an array, $values$, of n integers and an array, $freqs$, representing the respective frequencies of $values$'s elements, construct a data set, S, where each $values[i]$ occurs at frequency $freqs[i]$. Then calculate and print S's interquartile range, rounded to a scale of 1 decimal place (i.e., 12.3 format).

Tip: Be careful to not use integer division when averaging the middle two elements for a data set with an even number of elements, and be sure to *not* include the median in your upper and lower data sets.

Example
$values = [1, 2, 3]$
$freqs = [3, 2, 1]$

Apply the frequencies to the values to get the expanded array $S = [1, 1, 1, 2, 2, 3]$. Here $left = [1, 1, 1], right = [2, 2, 3]$. The median of the left half, $Q_1 = 1.0$, the middle element. For the right half, $Q_3 = 2.0$. Print the difference to one decimal place: $Q_3 - Q_1 = 2.0 - 1.0 = 1$, so print 1.0.

Function Description

Complete the *interQuartile* function in the editor below.

interQuartile has the following parameters:
- *int values[n]:* an array of integers
- *int freqs[n]:* $values[i]$ occurs $freqs[i]$ times in the array to analyze

Prints

- *float:* the interquartile range to 1 place after the decimal

Input Format

The first line contains an integer, n, the number of elements in arrays $values$ and $freqs$.
The second line contains n space-separated integers describing the elements of array $values$.
The third line contains n space-separated integers describing the elements of array $freqs$.

Constraints

- $5 \leq n \leq 50$
- $0 < values[i] \leq 100$

- $0 < \sum_{i=0}^{n-1} freqs[i] \leq 10^3$
- The number of elements in S is equal to $\sum freqs$.

Output Format

Print the *interquartile range* for the expanded data set on a new line. Round the answer to a scale of 1 decimal place (i.e., 12.3 format).

Sample Input

```
STDIN           Function
-----           --------
6               arrays size n = 6
6 12 8 10 20 16 values = [6, 12, 8, 10, 20, 16]
5 4 3 2 1 5     freqs = [5, 4, 3, 2, 1, 5]
```

Sample Output

```
9.0
```

Explanation

The given data is:

Element	Frequency
6	5
12	4
8	3
10	2
20	1
16	5

First, we create data set S containing the data from set $values$ at the respective frequencies specified by $freqs$:

$$S = \{6, 6, 6, 6, 6, 8, 8, 8, 10, 10, 12, 12, 12, 12, 16, 16, 16, 16, 16, 20\}$$

As there are an even number of data points in the original ordered data set, we will split this data set exactly in half:

Lower half (L): 6, 6, 6, 6, 6, 8, 8, 8, 10, 10

Upper half (U): 12, 12, 12, 12, 16, 16, 16, 16, 16, 20

Next, we find Q_1. There are 10 elements in $lower$ half, so $Q1$ is the average of the middle two elements: 6 and 8. Thus, $Q_1 = \frac{6+8}{2} = 7.0$.

Next, we find Q_3.There are 10 elements in $upper$ half, so $Q3$ is the average of the middle two elements: 16 and 16. Thus, $Q_3 = \frac{16+16}{2} = 16.0$.

From this, we calculate the interquartile range as $Q_3 - Q_1 = 16.0 - 7.0 = 9.0$ and print 9.0 as our answer.