

Day 7: Spearman's Rank Correlation Coefficient

Objective

In this challenge, we practice calculating *Spearman's rank correlation coefficient*. Check out the [Tutorial](#) tab for learning materials!

Task

Given two n -element data sets, X and Y , calculate the value of Spearman's rank correlation coefficient.

Input Format

The first line contains an integer, n , denoting the number of values in data sets X and Y .

The second line contains n space-separated real numbers (scaled to *at most* one decimal place) denoting data set X .

The third line contains n space-separated real numbers (scaled to *at most* one decimal place) denoting data set Y .

Constraints

- $10 \leq n \leq 100$
- $1 \leq x_i \leq 500$, where x_i is the i^{th} value of data set X .
- $1 \leq y_i \leq 500$, where y_i is the i^{th} value of data set Y .
- Data set X contains unique values.
- Data set Y contains unique values.

Output Format

Print the value of the Spearman's rank correlation coefficient, rounded to a scale of **3** decimal places.

Sample Input

```
10
10 9.8 8 7.8 7.7 1.7 6 5 1.4 2
200 44 32 24 22 17 15 12 8 4
```

Sample Output

```
0.903
```

Explanation

We know that data sets X and Y both contain unique values, so the rank of each value in each data set is unique. Because of this property, we can use the following formula to calculate the value of Spearman's rank correlation coefficient:

$$r_{xy} = 1 - \frac{6 \sum d_i^2}{N(N^2 - 1)}$$

Here, d_i is the difference between ranks of each pair (x_i, y_i) . The following table shows the calculation of d_i^2 :

X	Y	r_x	r_y	$d_i = r_x - r_y$	d_i^2
10	200	10	10	0	0
9.8	44	9	9	0	0
8	32	8	8	0	0
7.8	24	7	7	0	0
7.7	22	6	6	0	0
1.7	17	2	5	-3	9
6	15	5	4	1	1
5	12	4	3	1	1
1.4	8	1	2	-1	1
2	4	3	1	2	4

Now, we find the value of the coefficient:

$$r_{xy} = 1 - \frac{6 \times 16}{10 \times 99} = 1 - 0.09696969696 = 0.90303030303$$

When rounded to a scale of three decimal places, we get **0.903** as our final answer.