Questions of ITP course at Shahid-Beheshti-University

Part 6

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Sorting

Using the recursive sorting algorithm Merge Sort, write a program that sorts them in descending order after receiving a specified number of numerical data.

Entrance

In the first line, the number of data or n is written, and in the next line, the integer n is written in the standard input.

$$1 \le n \le 1000$$

$$-10000 \le ai \le 10000$$

Output

Print ordered numbers on a single line, separated by a space character, to standard output.

data analysis

Write a program that, upon receiving a certain number of correct and positive data, calculates the median statistical parameters and the coefficient of variation for them.

The functions that you must implement in this program are:

```
double median(int data[], int n);

double mean(int data[], int n);

double varience(int data[], int n, double avg);

double cov(double var, double avg);
```

- Functions calculate and subtract median, mean, variance and coefficient of variation respectively.
- The sorting algorithm used in this question is arbitrary.
- Using math.h or cmath library is allowed.

Entrance

n or the number of data is written in the first line.

In the next line, n correct data separated by spaces are written.

$$2 \leq n \leq 1000$$

$$0 \leq ai \leq 100$$

Output

In the first line, in the middle, and in the next line, print the change coefficient of the data with three decimal places.

Note that to print with 3 digits of precision, use setprecision or 3lf. Not enough because these methods round the output. To solve the problem, you can use multiplication and division and convert to int or use floor.

Explosion

In order to test a type of explosive material, we place a certain amount of it on each of the islands that are on a line. Even though we have placed the explosive on all the islands, we will only detonate one of them. The explosion has a specific radius and if an explosive substance is placed in the explosion radius, it will explode with the same radius.

Given the number of islands and the location of each of them, as well as the radius of the explosion and the starting location of the explosion, calculate the number of islands that will explode in this experiment.

Note: You may need to sort and search in this question. If you use the search, you must do it as Binary, but the sorting algorithm is optional.

Entrance

In the first line, two numbers n and r are written, which show the number of islands and the radius of the explosion, respectively.

In the next line, n is written as an integer and a positive number that shows the location of the islands. The first number is the starting point.

$$1 \leq n \leq 10000$$

$$0 \leq r \leq 50$$

$$1 \leq ai \leq 50000$$

Output

On one line of standard output, print the number of islands blown up in this experiment.

Multiply of matrix transpose

Write a program that, upon receiving the dimensions of two matrices, first checks whether the product of those two matrices can be multiplied together or not, and if they are multiplicative, it receives the matrices and calculates the product of their products.

Entrance

In the first line, r1 and c1 are written, which show the number of rows and columns of the first matrix, respectively, and in the second line, r2 and c2 are written in the same way for the second matrix. If the condition of multiplying the outputs is established in r1 of the next line, the number c1 is written, which shows the jth number in the ith line of the element ai, aj in the first matrix. In r2, the next line is also entered in the same way for the second matrix in verses.

$$1 \leq r, c \leq 50$$

$$-1000 \leq a_{i,j} \leq 1000$$

Output

If the condition of multiplication of the transmutation is not fulfilled, print the statement Undefined, otherwise, print the product of the transmutation of the two matrices in the standard output according to the examples.

Rotation

Write a program that receives a square matrix and only rotates it 45 degrees counter-clockwise.

Entrance

n or the number of rows and columns of the square matrix is written in the first line. Then in the n of the next line, in each line n, a small English letter is written, which shows the jth letter in the ith line of the element ai, aj of the matrix.

$$1 \leq n \leq 50$$

Output

Print the evolution of the matrix to standard output, following the examples and without printing extra spaces.