Day 5: Computing the Correlation

You are given the scores of **N** students in three different subjects - **Mathematics**,*Physics* and **Chemistry**; all of which have been graded on a scale of 0 to 100. Your task is to compute the Pearson product-moment correlation coefficient between the scores of different pairs of subjects (Mathematics and Physics, Physics and Chemistry, Mathematics and Chemistry) based on this data. *This data is based on the records of the CBSE K-12 Examination - a national school leaving examination in India, for the year 2013.*

Pearson product-moment correlation coefficient

This is a measure of linear correlation described well on this Wikipedia page. The formula, in brief, is given by:

$$r_{xy} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}.$$

where **x** and **y** denote the two vectors between which the correlation is to be measured.

Input Format

The first row contains an integer **N**.
This is followed by **N** rows containing three tab-space (*'\t'*) separated integers, **M P C** corresponding to a candidate's scores in Mathematics, Physics and Chemistry respectively.
Each row corresponds to the scores attained by a unique candidate in these three subjects.

Input Constraints

$1 <= N <= 5 \times 10^5$
$0 <=$ **M, P, C** $<= 100$
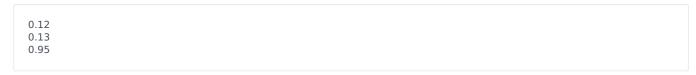
Output Format

The output should contain three lines, with correlation coefficients computed
and rounded off **correct to exactly 2 decimal places**.
The first line should contain the correlation coefficient between Mathematics and Physics scores.
The second line should contain the correlation coefficient between Physics and Chemistry scores.
The third line should contain the correlation coefficient between Chemistry and Mathematics scores.

So, your output should look like this (these values are only for explanatory purposes):

```
0.12
0.13
0.95
```

Test Cases

There is one sample test case with scores obtained in Mathematics, Physics and Chemistry by 20 students. The hidden test case contains the scores obtained by all the candidates who appeared for the examination and took all three tests (Mathematics, Physics and Chemistry).
Think: * How can you efficiently compute the correlation coefficients within the given time constraints, while handling the scores of nearly 400k students?*

Sample Input

```
20
73 72 76
```

```
48  67  76
95  92  95
95  95  96
33  59  79
47  58  74
98  95  97
91  94  97
95  84  90
93  83  90
70  70  78
85  79  91
33  67  76
47  73  90
95  87  95
84  86  95
43  63  75
95  92  100
54  80  87
72  76  90
```

Sample Output

```
0.89
0.92
0.81
```

There is **no special library support** available for this challenge.