26 The smart winemaker

12 points

Introduction

An Engineer from HP in Sant Cugat is starting up a small winemaking enterprise in his spare time.
One of the interesting issues he has discovered while researching the winemaking industry is that the price of the wine is not constant; some years customers are ready to buy more wine barrels and pay higher, while some other years they are reluctant and prices need to be lowered to get rid of wine in stores.
He has found that the reason for such behavior is simple; after rainy years grapes yield wine of better quality and people are more eager to purchase it.
This gives the engineer an idea; he needs to find the formula for calculating expected wine price is, depending on weather records from the preceding year (the wine sold in an specific year is prepared with the grapes picked the year before), so that price in the current year is set to the optimal and sales run more smoothly.
Your task is to help the Engineer create a program that calculates wine price for the current year. To keep things simple we will try approximating the dependency between rainfall and wine price with a linear function in a linear form:

$Y = K + X * B$, where X is the amount of rainy days and Y is the price.

For this task you will be given a list of records, each containing the number of rainy days during previous year along with the average price for which the wine was sold during that year.
We will use the simple, linear regression and the ordinary least squares criteria to find the parameters of the linear function which can approximate the dependence between price and amount of rainy days as follows:

$$B = \frac{Cov[x,y]}{Var[x]} = \frac{\sum x_i y_i - \frac{1}{n}\sum x \sum y}{\sum x_i^2 - \frac{1}{n}(\sum x_i)^2} \text{ and } K = \overline{y} - B\overline{x},$$

where $\overline{x}$, $\overline{y}$ is the mean of vector x and y respectively.

Remember that the mean $\overline{x}$ of a vector x can be calculated as $\overline{x} = \frac{\sum x_i}{n}$, where n is the number of elements in the vector.

Input

The input data will contain starting A and ending B year in the first line.
Then lines follow for each year in form YYYY: D P where YYYY is the mark of year, D is the number of rainy days (in previous season) and P is the wine price in euros per barrel.

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1925 1947
1925: 89 257
1926: 75 226
1927: 83 235
1928: 52 173
1929: 148 332
1930: 109 268
1931: 129 306
1932: 115 289
1933: 102 265
1934: 99 269
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1935: 50 228
1936: 102 265
1937: 91 256
1938: 79 238
1939: 118 298
1940: 134 311
1941: 61 155
1942: 146 340
1943: 108 274
1944: 96 242
1945: 89 232
1946: 143 328
1947: 133 303
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Output

Output should contain values for K and B with an accuracy of 0.001 or better.

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1.541 107.313
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