Small Risk Trading

by pkacprzak

A company can make *at most* k of n available trades. Each i^{th} available trade has the following properties:

- p_i: A floating-point number denoting the trade's probability of being profitable.
- x_i: A floating-point number denoting the trade's potential profit.
- y_i: A floating-point number denoting the trade's potential loss, which has a probability of $1 - p_i$.

Given the values of n, k, and x_i, y_i, and p_i for each trade i, find and print the maximum expected amount of money the company can make by performing *at most* k of the n trades.

Input Format

The first line contains two space-separated integers denoting the respective values of n (the number of trades available) and k (the maximum number of trades allowed).
The second line contains n space-separated floating-point numbers describing the respective values of $p_0, p_1, \ldots, p_{n-1}$, where each p_i denotes the probability that the i^{th} transaction will result in a profit.
The third line contains n space-separated floating-point numbers describing the respective values of $x_0, x_1, \ldots, x_{n-1}$, where each x_i denotes the possible profit of the i^{th} transaction.
The fourth line contains n space-separated floating-point numbers describing the respective values of $y_0, y_1, \ldots, y_{n-1}$, where each y_i denotes the possible loss of the i^{th} transaction.

Constraints

- $1 \leq k \leq n \leq 10^5$
- $0 < x_i, y_i \leq 100$
- $0 \leq p_i \leq 1$
- All p_i, x_i, and y_i are floating-point numbers scaled to exactly one decimal place (i.e., 12.3 format).

Output Format

Print the maximum expected amount of money that can be made by performing at most k of the n available trades. Scale your answer to exactly 2 decimal places (i.e., 1.23 format).

Sample Input 0

```
4 2
0.5 0.5 0.5 0.5
4.0 1.0 2.0 3.0
4.0 0.5 1.0 1.0
```

Sample Output 0

```
1.50
```

Explanation 0

There are $n = 4$ transactions available and we can perform *at most* $k = 2$ of them. We also know that the probability that each transaction results in a profit is 0.5. If the third and the fourth transactions are performed, the expected amount of money made from these transactions is: $0.5 \cdot 2.0 - (1 - 0.5) \cdot 1.0 + 0.5 \cdot 3.0 - (1 - 0.5) \cdot 1.0 = 1.5$; because this is greater than all the other possibilities we could calculate, we print 1.50 as our answer (recall that we must scale our answer to two decimal places).

Sample Input 1

```
2 2
0.9 0.5
1.0 0.5
100.0 0.4
```

Sample Output 1

```
0.05
```

Explanation 1

There are $n = 2$ transactions available and we can perform *at most* $k = 2$ of them. The probability that the first transaction is profitable is 0.9, while the probability that the second transaction is profitable is 0.5. We can maximize our potential profit by only performing the second transaction, which has an expected value of $0.5 \cdot 0.5 - 0.5 \cdot 0.4 = 0.05$; thus, we print 0.05 as our answer.

Contest ends in a day

Submissions: 1521

Max Score: 25

Difficulty: Medium

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Python 3

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Upload Code as File

Test against custom input

Run Code

Submit Code