Programming assignment: Trading A vs B

Introduction

There are two correlated stocks A and B which are listed on two different exchanges. It is known that on big news, the price of A tends to move earlier than the price of B. Therefore, one can try to trade stock B whenever the move in stock A is big. Your aim of this exercise is to build such an algorithm and measure the time lag between the two stocks. **The purpose of this exercise is for us to assess your programming skills**.

Data

You are given two sets of data, one each for A and B, and each containing two entries per row: timestamp and price, separated by a comma. The timestamps look like '2020-01-01 13:03:24.345624'. Assume that at any given time T, you can buy or sell the stock at the last price that we had before T.

Algorithm

Suppose that we can transfer data between the exchanges in **M = 40 milliseconds**. Our algorithm is as follows:

- Whenever there is a change in the price of A check if it changes by more than **c = 4.0**.
- If the price changes more than c, then assume that we can execute a trade in B after M milliseconds.
    - If A goes up by more than 4.0 then buy B after M milliseconds.
    - Else if A goes down by more than 4.0 then sell B after M milliseconds.
    - In both these cases, we do the opposite trade when the price of B changes.

Example

Suppose the data for A is

Timestamp	Price
2020-01-01 14:32:01.134555	98.23
2020-01-01 14:32:01.542685	99.20
2020-01-01 14:32:02.544883	103.68
2020-01-01 14:32:03.124550	103.54

And the same for B

Timestamp	Price
2020-01-01 14:32:01.129548	99.12
2020-01-01 14:32:01.698704	99.98
2020-01-01 14:32:02.594566	102.01
2020-01-01 14:32:02.600145	103.70

In this case, we know at 14:32:02.544883 that the price of stock A changed by more than 4.0. Therefore, we would buy stock B at 14:32:02.584883 for price 99.98 and sell it the next time the price changes which is at 14:32:02.594566 for price 102.01. We would make a profit of 2.03.

Goal

Your goal is to test if this algorithm is good or not. Calculate the profit or loss made by this algorithm. Assume that each time you trade B, you buy or sell one unit. **When you are sending your solution, indicate in bold in your email the total profit you would make with this algorithm.**

Variations

This is an extra part which you can work on in case you have time for it.

We have made a choice of M and c. We want to know the largest value of M for which the algorithm is profitable.