1. Worst Trade Reporter

You are tasked with building a tool to analyze the profitability of *trades* (also known as "profit and loss" or PnL). For the purpose of this problem, every *trade* has the following attributes:

- *TradeID* - unique identifier for the trade,
- *InstrumentID* - identifier of the instrument that has been traded,
- *Buy/Sell* - flag to indicate whether you bought or sold the instrument,
- *Price* - the price at which the instrument has been traded,
- *Volume* - the quantity of the instrument that has been traded.

Consider a trade with the following attributes:

- *TradeID* = 5,
- *InstrumentID* = `Google`,
- *Buy/Sell* = `BUY`,
- *Price* = 500,
- *Volume* = 20.

It means that you bought 20 lots of Google stock for 500 dollars and the identifier for the trade is 5.

Note that trades have a *TradeID* because there can be multiple trades with the same *InstrumentID*, *Buy/Sell*, *Price* and *Volume* attributes.

Problem Statement

In this task, you receive a stream of *N* instructions. Each instruction can be an update or a query.

An update can be of 2 kinds:

- *Trade* - indicates that a trade has happened. Attributes: *TradeID*, *InstrumentID*, *BUY/SELL*, *Price*, and *Volume*.
- *Price* - indicates that the true value of an instrument has been updated. Attributes: *InstrumentID* and *Price*.

There is only 1 kind of query:

- *WorstTrade* - output the *TradeID* of the *worst trade* for an instrument. Attributes: *InstrumentID*.

The *WorstTrade* is the trade with the highest loss made per-lot of the trade. To calculate PnL of a trade the latest price update for an instrument is used as the true value of the instrument.

- If you sell 2 `Google` stocks for 500 each, and had the latest price update saying `Google` is worth 400, the PnL for the trade is (500 - 400) * 2 = 200.
- If you later get a price update saying `Google` is worth 600, the PnL for the same trade is (500 - 600) * 2 = -200

In the example above, initially we make a profit-per-lot of 200 / 2 = 100, and after the price update it is a loss-per-lot of 200 / 2 = 100.

- In case of ties for the worst trade, output the latest one.
- In case there are no trades that result in a loss for the instrument, output `NO BAD TRADES`.

Function Description
Your task is to implement a class that provides methods `ProcessTrade`, `ProcessPriceUpdate`, `OutputWorstTrade`. These method calls correspond to the instructions described above with the method arguments corresponding to the update or query attributes.

Constraints

- $1 \le N, TradeId, Price, Volume \le 10^6$
- It is guaranteed that price update for an instrument is available before first trade on that instrument.

▸ **Input Format For Custom Testing**

▾ **Sample Case 0**

Sample Input For Custom Testing

```
6
PRICE Facebook 80
PRICE Apple 120
TRADE 100 Apple SELL 90 2
TRADE 10 Facebook BUY 100 4
WORST_TRADE Facebook
WORST_TRADE Apple
```

Sample Output

```
10
100
```

Explanation
There are 2 instruments (`Apple` and `Facebook`), each of which has 1 trade. There are 2 queries, 1 for each instrument.

1. PNL from tradeID 100: (90 - 120) * 2 = -60
   - Apple price at the time of the trade is 120 and we sell at 90, so we make a total loss of 60. We trade 2 lots, so the loss-per-lot is 30:
2. PNL from tradeID 10: (100 - 80) * 4 = 80
   - Facebook price at the time of the trade is 80 and we buy at 100, so we make a total loss of 80. We trade 4 lots, so in total we make a loss-per-lot of 20.

For both `Facebook` and `Apple`, we do exactly one bad trade which is hence also the worst trade for each instrument.

▾ **Sample Case 1**

Sample Input For Custom Testing

```
10
PRICE Google 100
TRADE 1 Google BUY 100 10
WORST_TRADE Google
TRADE 2 Google SELL 102 5
TRADE 3 Google SELL 103 5
PRICE Google 98
WORST_TRADE Google
TRADE 4 Google BUY 101 10
TRADE 5 Google BUY 100 10
WORST_TRADE Google
```

Sample Output

```
NO BAD TRADES
1
4
```

Explanation
First *WorstTrade* query:

- PNL from tradeID 1: (100 - 100) * 10 = 0.
- There are no trades that result in a loss (PNL < 0), so there are no bad trades.

PnLs before second *WorstTrade* query:

- PNL from tradeID 1: (98 - 100) * 10 = -20
- PNL from tradeID 2: (102 - 98) * 5 = 20
- PNL from tradeID 3: (103 - 98) * 5 = 25

Second *WorstTrade* query:

- From the PNL values above, only trade with tradeID 1 results in a loss, so it is indeed the worst trade

PnLs before third *WorstTrade* query:

- Net PNL for tradeID 1, 2, 3: 25
- PNL from tradeID 4: (98 - 101) * 10 = -30
- PNL from tradeID 5: (98 - 100) * 10 = -20

Third *WorstTrade* query:

- There are 3 trades (tradeID = 1,4,5) that result in a loss and the loss per lot for each of them are 2, 3 and 2 respectively.
- So worst trade would be trade with tradeID 4.