Hackathon

Business Rules

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# Events

#### Market Quote event

This event relates to a top of the book (best quote) update for a particular currency pair on a particular trading venue/liquidity provider. The event provides with the below information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
|  |  |  |  |  |

1. timestamp – Time when the event was sent
2. Ccy Name – Name of the currency pair eg – AUDUSD

AUD is called as the first leg or first ccy in the pair

USD is called as the second leg or second ccy in the pair

1. Venue – Name of the trading venue/liquidity provider eg- RFX (Reuters), CITI (Citibank)
2. bid – Rate at which first leg (ccy) in the pair is available for buying
3. ask – Rate at which first leg (ccy) in the pair is available for selling
4. Example

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
| 01:00:00.319200000 | AUDUSD | AGG | 0.7514 | 0.75143 |

1. The bid rate/ask rate in a quote event is always a unit of the second ccy in the pair i.e the rate is expressed as ‘how many units of second ccy’ required to ‘buy/sell first ccy’.
2. So in the above example it tells us how many US dollars we would need/get in return for buying or selling 1 Australian Dollar (AUD). In order to buy 1 AUD we would have to pay 0.7514 USD and when we sell 1 AUD we will get 0.75143 USD.

**Tip** – Used in the calculation of ‘mkt’,’pnl’ and ‘Posusd’ column in the resulset

#### Deal Event

This event relates to a client dealing a particular currency with ANZ bank. The event provides the following information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Timestamp | CCy Pair | Qty (1st ccy in ccy pair) | Price | Side (1st ccy in the pair) |
|  |  |  |  |  |

1. timestamp – time when then event was sent
2. sym – currency pair that was dealt with ANZ (eg AUDUSD)
3. qty – amount that was dealt
4. price – rate at which the amount was dealt. The price is always a unit of the second ccy in the pair i.e price is expressed as ‘how many units of second ccy’ required to ‘buy/sell first ccy in the pair
5. side – direction of the deal with respect to the first ccy in the pair. Tells us whether the first ccy was bought or sold in exchange for second ccy in the pair.
6. Example

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Timestamp | Ccy Pair | Qty (1st ccy in ccy pair) | Price | Side (1st ccy in the pair) |
| 01:00:00.319200000 | AUDUSD | 1000000 | 0.7514 | B |

1. The above example tells us that ANZ bought 1000000 AUD (first ccy in the pair) and sold 751400 USD (second ccy in the pair) at the rate of 1 AUD = 0.7514 USD.

**Tip** – Used in the calculation of all columns except ‘mkt’ in the resultset

# Rules

#### On Market Quote Event

We need to track the current market price for a given currency in order to calculate the pnl. We can look at particular trading venue as our market reference or use an aggregated price across all the venues. The ‘AGG’ venue signifies the aggregated price across all the venues. Hence we need to only process market events for ‘AGG’ mkt. We need to maintain the mid prices of each currency with respect to USD. So we need to only process updates for rates related to USD. Lastly, we calculate pnl with respect to mid-price.

The bid and ask are always quoted for the first currency in the pair with respect to the second currency in the pair. In other words, the bid rate/ask rate in a quote event is always a unit of the second ccy in the pair i.e the rate is expressed as ‘how many units of second ccy’ required to ‘buy/sell first ccy’.

So eg- AUDUSD, the bid and ask are mentioned for AUD with respect to USD i.e it tells that in order to buy/sell 1 AUD how many USD we spend or get. So if there is any pair that is reported in any other way, we need to make appropriate adjustments by inversing the bid/ask rate. Eg USDCAD, in order to store CAD with respect to USD, we need to inverse the price.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
| 01:00:00.319200000 | USDCAD | AGG | 1.3173 | 1.3177 |

Since we need to maintain market rates with respect to USD, we need to inverse the price i.e Bid Rate = 1/Bid Rate , Ask Rate = 1/Ask Rate

The above quote then becomes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
| 01:00:00.319200000 | CADUSD | AGG | 0.75912 | 0.75889 |

Summarizing the above, we need to consider the below for market events

1. Only process ‘AGG’ mkt events
2. Only process USD rates by making any adjustments required
3. Calculate the mid-price for each event as 0.5\*(bid rate + ask rate)
4. So at any point in time you would have a cache of mid prices per currency as below

|  |  |
| --- | --- |
| **CCY** | **Current Market Mid-Price** |
| AUDUSD | 0.7514 |
| CADUSD | 0.75901 |

1. Data points to be recalculated
   1. Current market mid
   2. Pnl
   3. Position expressed in USD

#### On Deal Event

There are multiple things we need to track of from the deal done with particular client. We need to track the following things.

1. Weighted Average price at which ANZ bought a currency from different clients
2. Weighted Average price at which ANZ sold a currency from different clients.

Weighted Average prices means – price needs to be weighted where the weight is the amount that was traded.

Eg: Consider the below two deals where ANZ bought AUD and sold USD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Timestamp | Ccy Pair | Qty (1st ccy in ccy pair) | Price | Side (1st ccy in the pair) |
| 01:00:00.319200000 | AUDUSD | 1000000 | 0.7514 | B |
| 01:00:00.319200000 | AUDUSD | 5000 | 0.7500 | B |

weighted average buy price(AUD) = (1000000\*0.7514)+(5000\*0.7500) = 0.75139

1000000+5000

A deal always involves two legs – a client sells/buys one currency in exchange of another. So every deal will affect the pnl’s/positions for two currencies. Since we are calculating the pnl with respect to usd, there are different ways in which we need to handle the processing of the deal event

1. If the client has dealt in USD (i.e the second ccy in the pair is USD. Eg AUDUSD), then we just need to compute the averages mentioned above
2. If the client has dealt in othr ccy (i.e the first ccy in the pair is USD), then we need to inverse the price and compute the averages mentioned above.
3. If the client has not dealt in USD (i.e none of the deal legs (first or second ccy in the pair) is USD eg – AUDEUR), then we need to break the deal into two equal and opposite deals.
4. Example 2016.07.20D01:00:00.319200000 AUDEUR 1000000 0.68056 B

The above deal needs to be broken into two legs

AUDUSD 1000000 1.0577 B

EURUSD 680560 1.3929 S

1. Data points to be recalculated on each deal event.
   1. Weighted average buy price
   2. Weighted average sell price
   3. Position
   4. Position expressed in USD.
   5. Pnl
   6. Book
2. If the position changes from short (negative) to long (positive) or vice versa as a result of the deal event, then we need to reset following to 0.
   1. Pnl
   2. Weighted average buy price
   3. Weighted average sell price

# Column Calculation Guidelines

|  |  |
| --- | --- |
| **Column Name** | **Calculation** |
| Ccy | Name of the currency |
| Pos  (To be reported in millions) | Current position of the currency (To be reported in millions) |
| PosUsd (To be reported in millions) | Current position of the currency in USD (+ for buy, - for sell) |
| Age | Time since the position has not been updated (To be reported in mins) |
| Pnl  (To be reported in thousands) | Pnl = ((absolute posusd) \* ((Current Market Mid-price – Weighted average buy price) +  (Weighted average sell price – current market Mid-price)))/1000 |
| Book Mid-Price | Average execution price = 0.5 \* ((Weighted Average buy price) +  (Weighted Average sell price)) |
| Mkt Mid-Price | Current market mid = 0.5 \* (bid+ask) |

# Working Example

Below is a step by step illustration of how different events would affect the state of the application. Only two ccys (AUD and CAD) are illustrated for demonstration purpose.

## Initial State

The initial state of the application will have all the state variables set to 0.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ccy | Pos | Posusd | Age | Pnl | Book mid price | Market mid price |
| AUD | 0 | 0 | 0 | 0 | 0 | 0 |
| CAD | 0 | 0 | 0 | 0 | 0 | 0 |

## Sequence of events

1. We receive below two market quote events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
| 01:00:00.319200000 | USDCAD | AGG | 1.3173 | 1.3177 |
| 01:00:00.319200000 | AUDUSD | AGG | 0.7514 | 0.75143 |

The current stat is as below – change in market mid price

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ccy | Pos | Posusd | Age | Pnl | Book mid price | Market mid price |
| AUD | 0 | 0 | 0 | 0 | 0 | 0.75142 |
| CAD | 0 | 0 | 0 | 0 | 0 | 0.75901 |

1. We receive two deal events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Timestamp | Ccy Pair | Qty (1st ccy in ccy pair) | Price | Side (1st ccy in the pair) |
| 01:00:00.319200000 | AUDUSD | 1000000 | 0.7514 | B |
| 01:00:00.319200000 | AUDUSD | 500000 | 0.7513 | B |

The state would change to below – change in book mid price, pos and pnl

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ccy | Pos | Posusd | Age | Pnl | Book mid price | Market mid price |
| AUD | 1500000 | 1127050 | 1 | 0.067 | 0.75136 | 0.75142 |
| CAD | 0 | 0 | 0 | 0 | 0 | 0.75901 |
| USD | -1127050 | -1127050 | 1 | 0 | 0 | 0 |

1. We receive one more deal event

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Timestamp | Ccy Pair | Qty (1st ccy in ccy pair) | Price | Side (1st ccy in the pair) |
| 01:00:00.319200000 | AUDCAD | 1000000 | 0.74827 | B |

The state would change to below - change in book mid price, pos and pnl

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ccy | Pos | Posusd | Age | Pnl | Book mid price | Market mid price |
| AUD | 2500000 | 1878470 | 1 | 0.056 | 0.75139 | 0.75142 |
| CAD | -748270 | -567944.4 | 1 | 0 | 0.75901 | 0.75901 |
| USD | -1127050 | -1127050 | 1 | 0 | 0 |  |

1. We receive two market quote events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| timestamp | Ccy Name | Mkt Venue | Bid Rate | Ask Rate |
| 01:00:00.319200000 | USDCAD | AGG | 1.3176 | 1.3178 |
| 01:00:00.319200000 | AUDUSD | AGG | 0.7515 | 0.75146 |

The state would change to below – change in market mid price, posusd, pnl

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ccy | Pos | Posusd | Age | Pnl | Book mid price | Market mid price |
| AUD | 2500000 | 1878700 | 1 | 0.169 | 0.75139 | 0.75148 |
| CAD | -748270 | -567854.6 | 1 | 0.068 | 0.75901 | 0.75889 |
| USD | -1127050 | -1127050 | 1 | 0 | 0 |  |