tankX

HFT Quant - Case Study

Real-Time Arbitrage Monitoring

TankX Hiring Team

Introduction

Financial markets demand real-time data processing and low-latency communication. WebSocket technology enables bi-directional, low-latency communication between clients and servers. In response to these ever-evolving markets, we are committed to continuously testing and updating our technologies to stay at the forefront of industry standards.

As a quantitative analyst (HFT Quant), handling fast-changing real-time financial data, analyzing it, and building trading models using the latest technologies will be a part of your daily routine. Moreover, a significant aspect of your role involves the ongoing evaluation and improvement of these trading models ensuring they deliver optimal performance. So, this practice test has been designed to offer a concise sample of an authentic use case that aligns with the skills required for the position, aiming to evaluate your proficiency in data handling and analysis before building trading models with Python.

In this case study, your objective is to analyze and observe rapidly changing real-time financial data to determine whether there is an arbitrage opportunity in the provided market. Because there is no free public data in traditional financial markets, you will retrieve data from Binance for the case.

You're expected to get book ticker data of Binance that can be retrieved by using any public library. You should open a WebSocket stream to get the book ticker data using the stream name, "<symbol>@bookTicker". The related API documentation of Binance can be found in the following link: https://binance-docs.github.io/apidocs/spot/en/#individual-symbol-book-ticker-streams.

You can submit your solution by emailing the files, sharing a public GitHub project, or using any other suitable method. It is preferred that your code and/or analysis files are clear, and easy to read. Additionally, you are required to prepare a presentation for your findings. The format is up to you, but we encourage clear and concise presentations focusing on key insights. In the 45-minute interview session, your presentation should last about 5 minutes, with the remaining time dedicated to discussion.

You will have **7 days** to submit your response after receiving the email.

Real-Time Arbitrage Monitoring – The Case

The TankX modeling team consistently analyzes financial market data to stay informed about potential opportunities. This analysis guides their decisions on whether to pursue model development and make investment decisions related to the market in question.

In this task, your responsibility is to analyze real-time book ticker data from Binance and identify potential arbitrage opportunities. Your tech lead has instructed you to select a subset of all trading pairs on Binance, observe, and record any identified arbitrage instances. Your subset should not include more than 500 pairs because of the limitation of Binance WebSocket. (Example pairs: BTCUSDT, ETHUSDT, USDTTRY, BTCTRY, ETHBTC, BTCEUR, etc.)

You can see an example payload in the related documentation for Binance's book ticker data. The best bid price represents the highest available sell price, whereas the best ask price corresponds to the lowest available buy price for us. Although the payload also includes quantity data, for this case study, your analysis should exclusively concentrate on the price data.

After establishing a WebSocket connection for your selected trading pairs, you are tasked with monitoring and identifying any instances of triangular arbitrage. Triangular arbitrage can be defined as follows:

Let A, B, C be the assets, and ${}^{A}/_{B}, {}^{B}/_{C}, {}^{A}/_{C}$ be the pairs traded in a market. As an example, let P_{AB}^{ask} represent ask price of pair ${}^{A}/_{B}$.

If there is any inequality such that,

$$P_{AB}^{ask} * P_{BC}^{ask} * {}^{1}/_{P_{AC}^{ask}} < 1 \; or \; P_{AB}^{bid} * P_{BC}^{bid} * {}^{1}/_{P_{AC}^{bid}} > 1$$

we can conclude that there is an arbitrage in this market (fees are not considered for this case).

Your goal is to report any observed arbitrages. For a more focused analysis, identify trading pairs with higher arbitrage potential, particularly those with high price discrepancies.

Best of luck!