Week 1 Report – Market Microstructure and Order Book Simulator

This week, I focused on understanding how financial markets work internally and how orders are converted into trades. Instead of using real market data, I implemented a simplified simulator to study the basic mechanics of an exchange.

The core part of the work was building a limit order book. Orders were classified into buy and sell orders and stored separately. Buy orders were sorted based on highest price first, while sell orders were sorted based on lowest price first. When prices were equal, timestamp was used to ensure first-in-first-out execution. This helped me understand how price-time priority works in real exchanges.

After implementing order insertion, I added a matching mechanism. Whenever the best bid price was greater than or equal to the best ask price, a trade was executed. Partial fills were allowed, and orders remained in the book until their quantity became zero. Running the same order sequence multiple times produced identical results, which confirmed that the simulator behaves deterministically.

I then analyzed basic liquidity properties of the order book. The bid-ask spread was calculated using the best bid and best ask prices. Market depth was computed by aggregating quantities at each price level. By plotting depth charts, it became clear how liquidity near the best prices affects price impact and stability.

In addition to coding, I designed a system-level architecture diagram. The diagram shows how different agents interact with the market environment by sending orders, how the order book processes them, and how executed trades are logged. This helped me visualize the full flow from agent actions to trade execution.

Overall, this week helped me build a strong foundation in market microstructure. Although the simulator is simplified, it captures the essential ideas behind order-driven markets and provides a base that can be extended with more complex agents and learning algorithms in later stages.