Designing an Exchange

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1 Introduction

The aim of this project is to provide insight into the inner workings of an exchange as well as the orderbook matching algorithms used. I have chosen to conduct this in C to force myself to learn the language. C does also provide benefits such as fast execution speeds and direct access to memory, both which are core to creating a good exchange. This documentation will discuss the choices made as well explanations of the relevant algorithms used. Eventually, a server will be set up to allow multiple agents to trade, mimicking a real exchange.

2 Order Types

We have decided to select a few order types that can be excecuted, these reflect the most common trades made and will allow the user to have enough flexibilty to be useful. Though not in surplus of features, the aim of this project is on the order matching algorithm, not on the wants of the user.
The different types being offered include:

1. Market Orders
2. Limit Orders
3. Stop-loss Orders
4. Stop-limit Orders
5. Immediate or Cancel
6. Fill or Kill
7. Good 'Til Cancelled

2.0.1 Market Orders

These are the most trivial of orders, simply buying or selling at or near the posted price. These guarantee a position in market and will be excecuted as soon as possible.

2.0.2 Limit Orders

Limit orders can be thought of as pending orders that are only executed once a certain condition or limit is reached. This limit is based on the price of the security being traded. The order will be cancelled if the price is not met whilst trying to sell or buy at the pre-determined level. 4 types of Limit orders exist: Buy limit, Sell limit, Buy stop, and Sell stop.
Buy Limits allow you to purchase a given security at or below the specified price. To complement that, the Sell limit allows you to sell the given security at or above the specified price. Buy stops allow you to buy a given security at a price above the current market bid price. Therefore the Sell stop is in place to allow a security to be sold at a price below the current market ask.

2.0.3 Stop-loss Orders

This order type, unlike Market and Limit orders, remain inactive until a certain price threshold is met. At this point is behaves like a market order.

2.0.4 Immediate or Cancel

This order dictates that the whatever amount of an order can be fulfilled must be done as soon as possible with the rest of the order being cancelled.

2.0.5 Fill or Kill

This one is similar to Immediate or Cancel however either the entire order must be executed in a short amount of time otherwise be cancelled.

2.0.6 Good 'Till Cancelled

This order applies a time restriction so that the order will remain active until the order is cancelled by the user.

3 Orderbook Design

The orderbook design is crucial, one we must consider carefully encorporating the use case for our exchange. The two main branches we could explore is Central Limit Order Book (CLOB) or the Automated Market Maker Model (AMM).