Imperial Algorithmic Trading Society

Week 1: Course introduction and algorithmic trading basics

Welcome everyone!

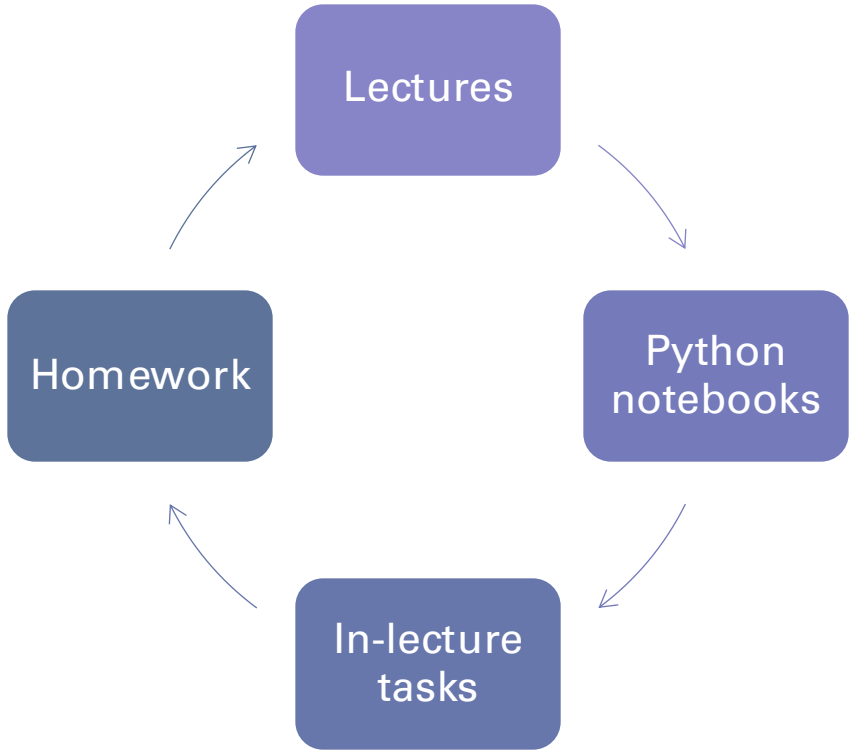
Join the WhatsApp chat!

Join the mailing list!

A Course Overview

How the course is taught

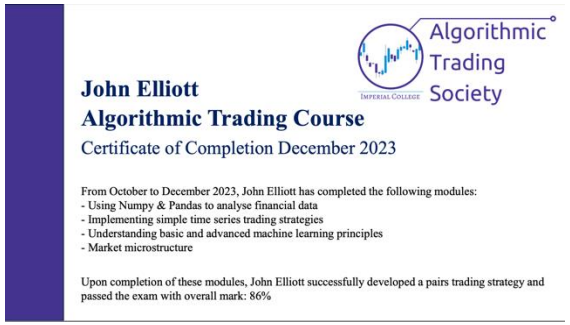
- Each lecture has two parts: **PPT and Python notebook**
  - Include in-lecture mentis, quizzes and python tasks
  - Some lectures will have optional Python HW tasks
- There will be **industry given lectures** on company niches (to be confirmed!)



How the course is assessed

Attendance	14 %	Recorded throughout
Multiple Choice Quiz	50 %	End of Term
Trading strategy challenge	36 %	End of Term

Pass Mark: 50%
Merit: 60%
Distinction: 70%
Certificates Awarded!


Algorithmic Trading Society
IMPERIAL COLLEGE

John Elliott

Algorithmic Trading Course

Certificate of Completion December 2023

From October to December 2023, John Elliott has completed the following modules:
- Using Numpy & Pandas to analyse financial data
- Implementing simple time series trading strategies
- Understanding basic and advanced machine learning principles
- Market microstructure

Upon completion of these modules, John Elliott successfully developed a pairs trading strategy and passed the exam with overall mark: 86%

Register your attendance

The fundamentals

What is Algorithmic Trading?

Algorithmic Trading

Using computer programs to **create strategies** that execute trades based on preset rules

Automated Trading

A system that executes trades without human intervention, following predefined strategies

We have made our strategies – how do we validate them?

Backtesting!

What is backtesting?

Backtesting

- Testing a trading strategy on historical data to see how it would have performed.
- Backtesting provides important feedback on a strategy’s robustness before its deployed in live markets

We have a validated strategy – what do we trade?

Securities!

Securities word cloud

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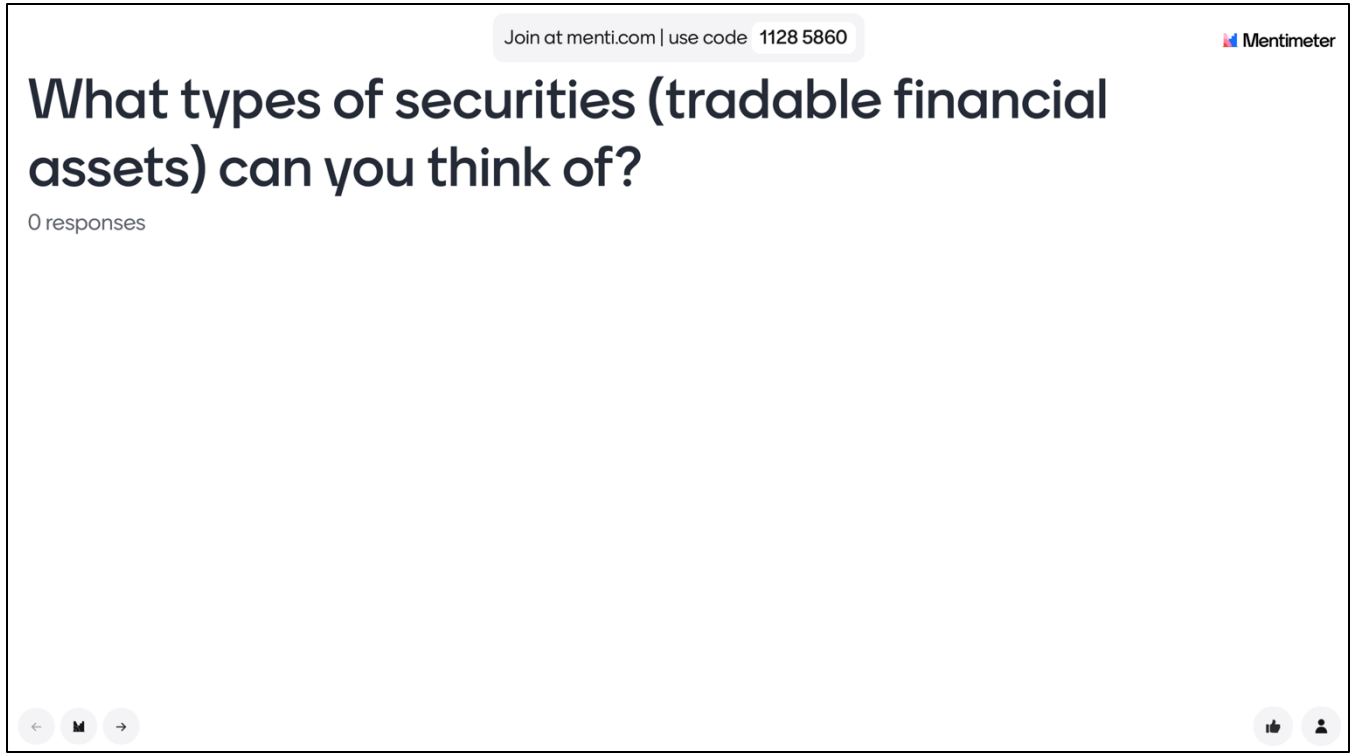


Main types of securities

Equities

Shares of ownership in a company (stocks), offering potential growth and returns

Bonds

Debt instruments offered by entities, providing fixed interest, but less relevant to high-frequency trading

Derivatives

Financial contracts whose value depends on an underlying asset, used for hedging or leverage

Other common terms

- Volatility
- Liquidity/Volume
- Hedging

Terms explained

Volatility

The degree of price fluctuation in a market, indicating both risk and trading opportunities

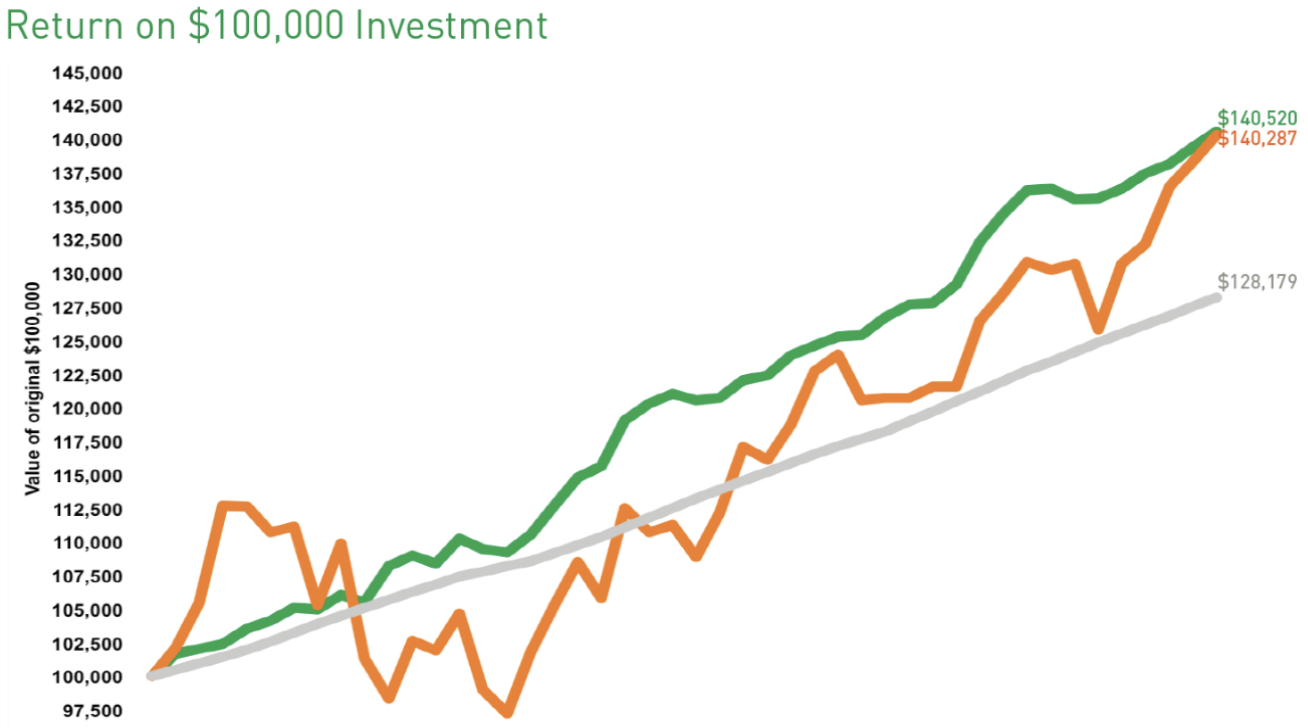
Liquidity/Volume

- Liquidity: The ease at which an asset can be bought/sold without causing a significant change in its market price
- Volume: The total quantity of an asset traded over a period – this impacts liquidity

Hedging

Mitigating the risk of a portfolio by taking offset positions to prevent losses e.g. uncorrelated stocks, options contracts *(Options L4)*

Which stock is more volatile?



Lecture 2 and beyond!

Both stocks have the same return – which would we prefer **long term**? … **short term**?

Why do we algorithmic trade?

Is it worth it? What are the advantages?

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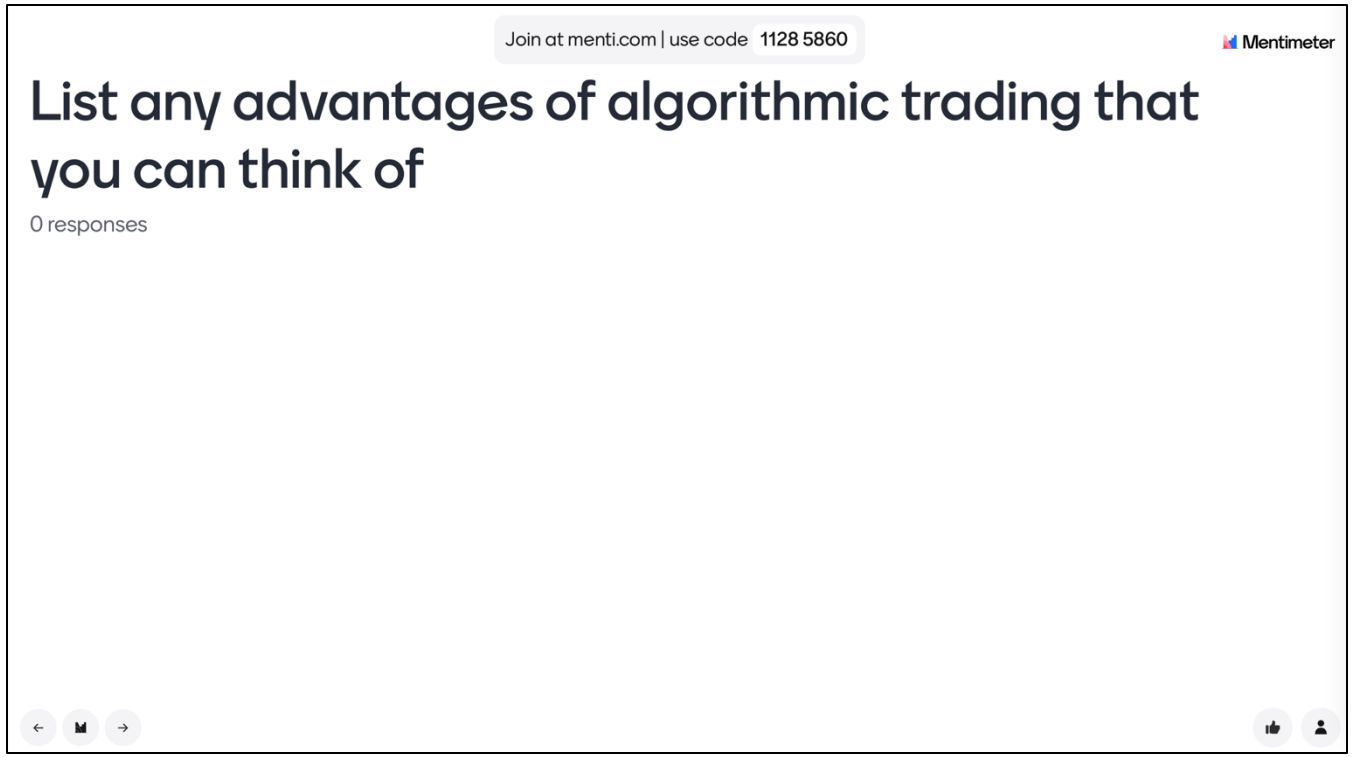
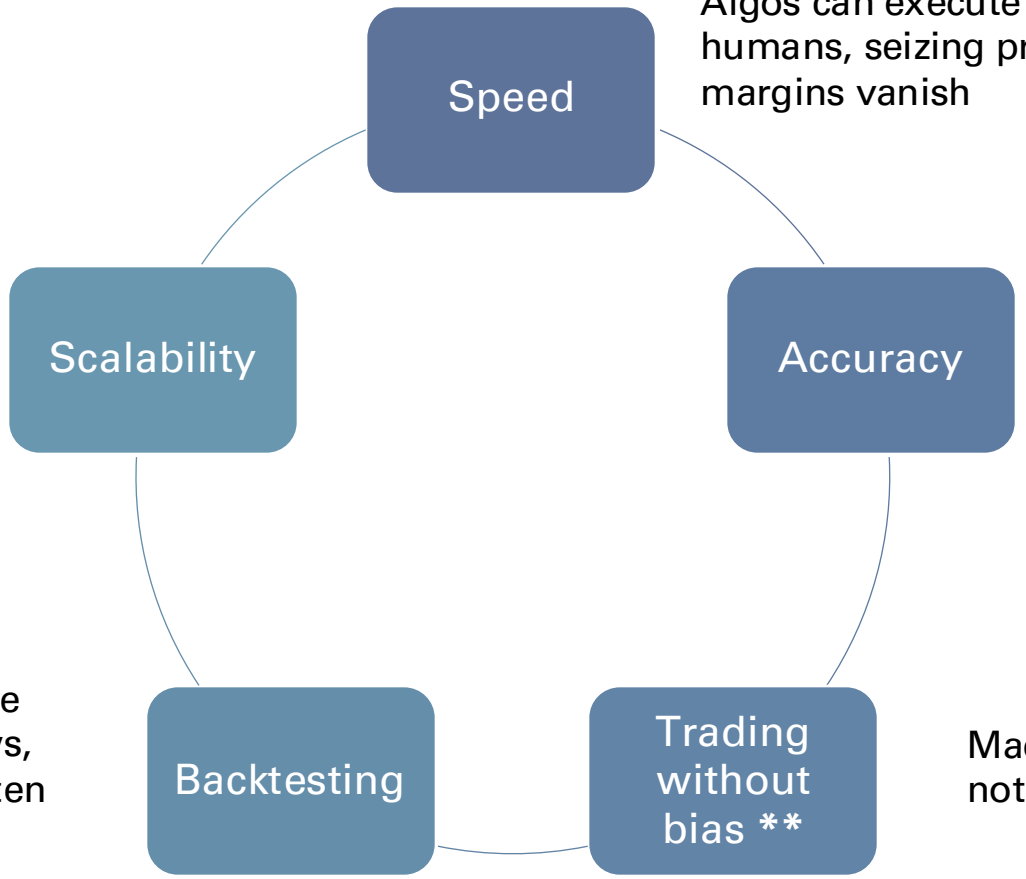


Advantages of algo-trading

Algos can execute trades 1000s of times faster than humans, seizing profit opportunities before the margins vanish

Machines can run multiple strats across 1000's of assets simultaneously and continuously - humans can't



Computers execute trades flawlessly eliminating human 'fat finger error' - *Citi 2022 £1.1bn mistaken orders*

Algos are validated to optimize performance and identify flaws, while discretionary trading often relies on intuition

Machines follow preset rules, and are not influenced by emotion or bias

Does algo-trading have a downside?

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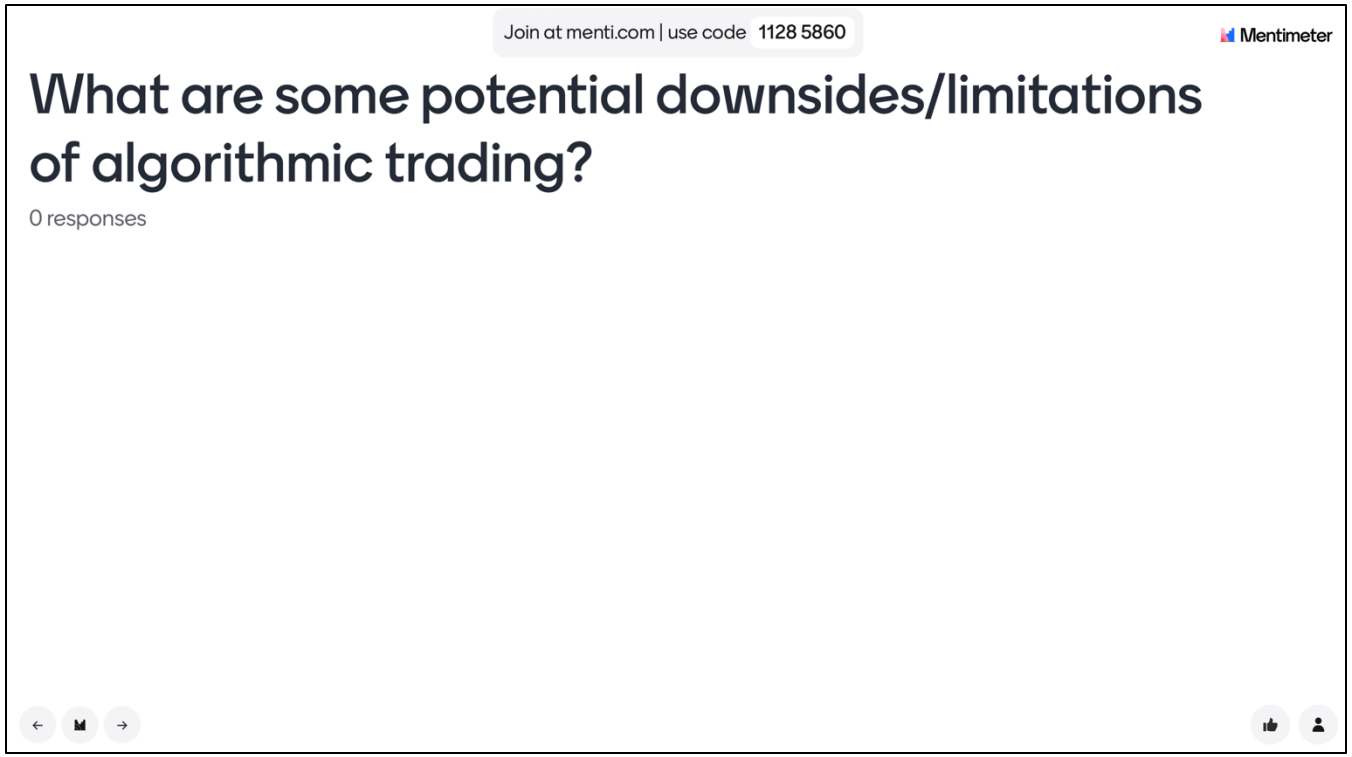
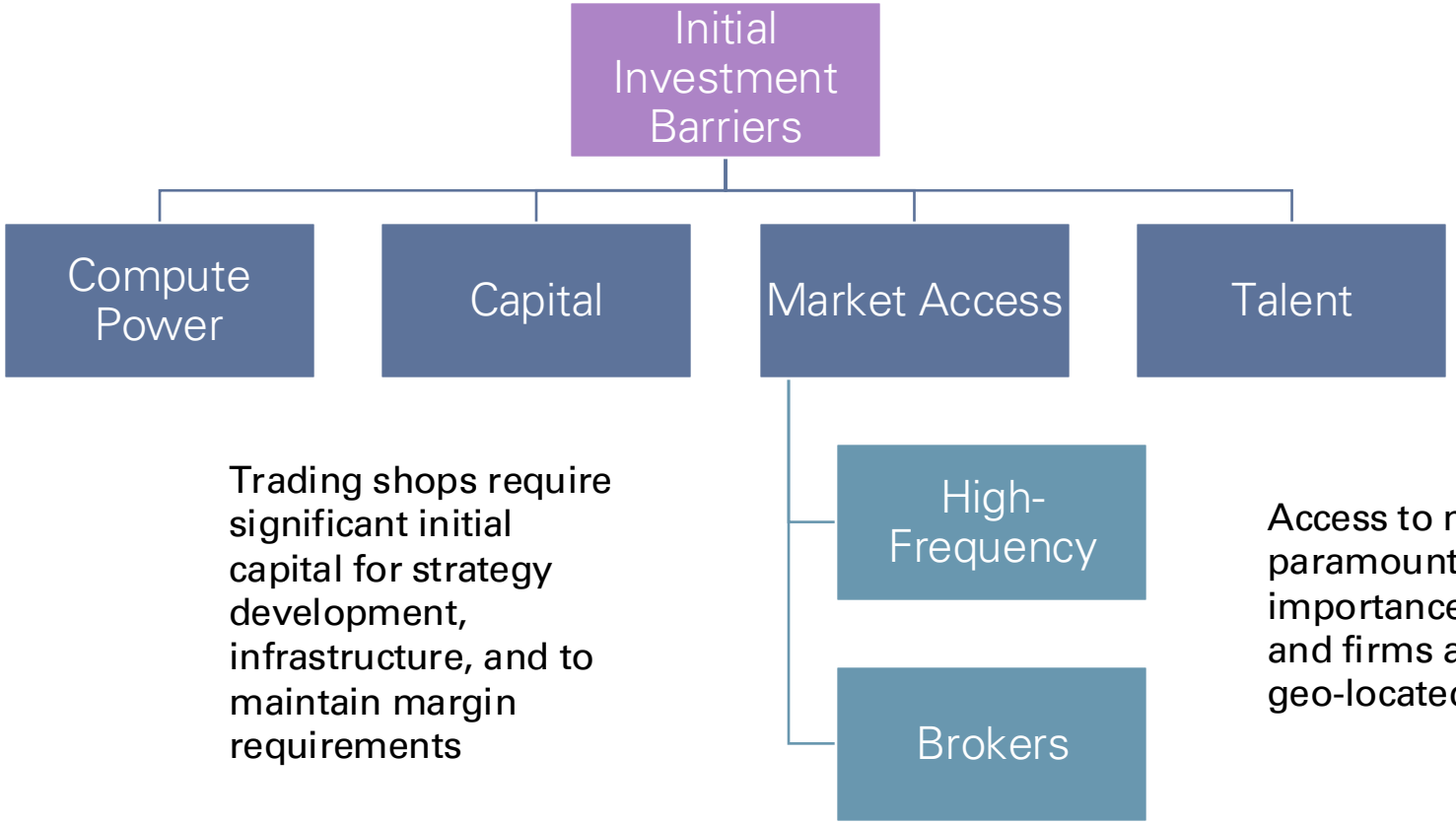


Drawbacks and limiting factors

(if you want to start a trading shop)



Complex strategies require significant compute power – insufficient resources severely limit execution and efficiency

HF's require substantial academic talent to create successful strategies – firms often poach!

Trading shops require significant initial capital for strategy development, infrastructure, and to maintain margin requirements

Access to market is of paramount importance for speed, and firms are often geo-located

What sort of numbers are we talking?

Terabytes of usable storage? RAM?

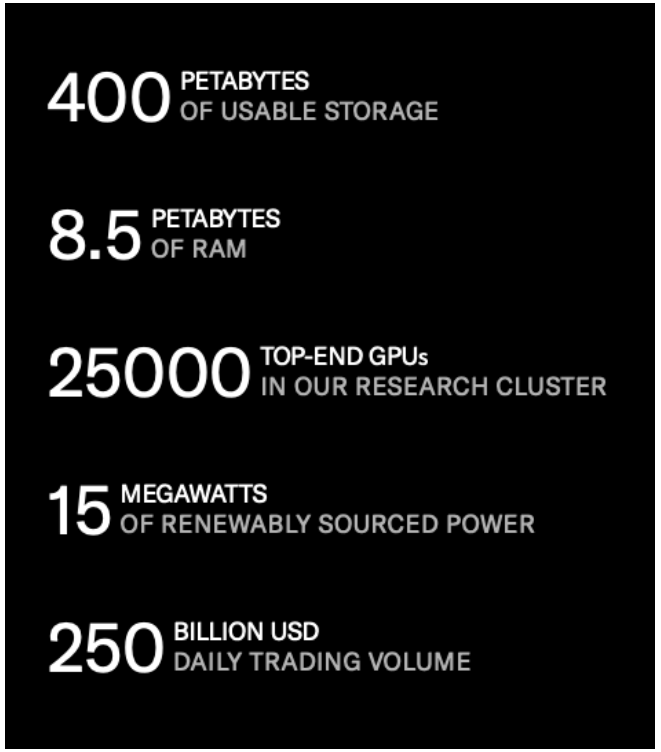
Amount of power used?

Daily trading volume?

Magnitude of resources at HF’s disposal

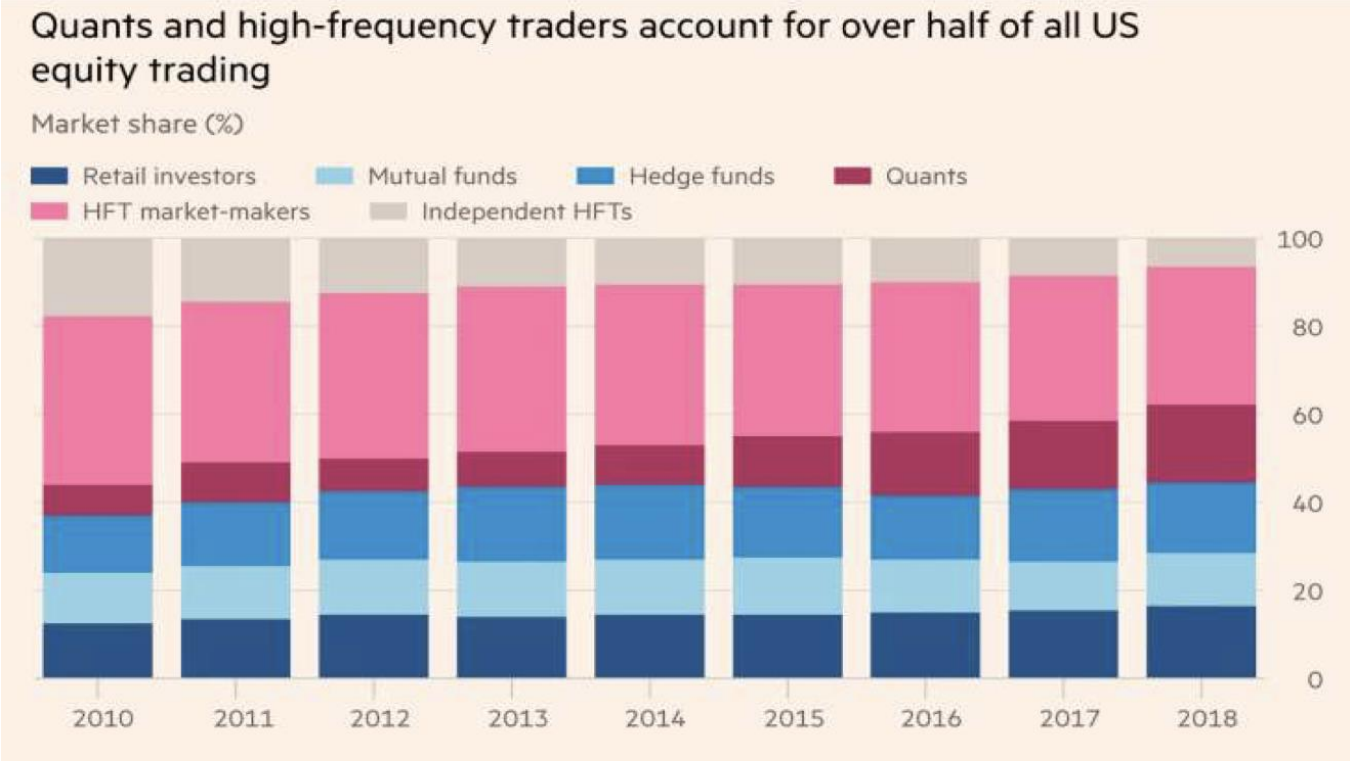
XTX markets’ substantial amount of **compute power** and **capital** that they trade with

HF’s have more GPU’s than some country’s governments!



The advantages outweigh the risks

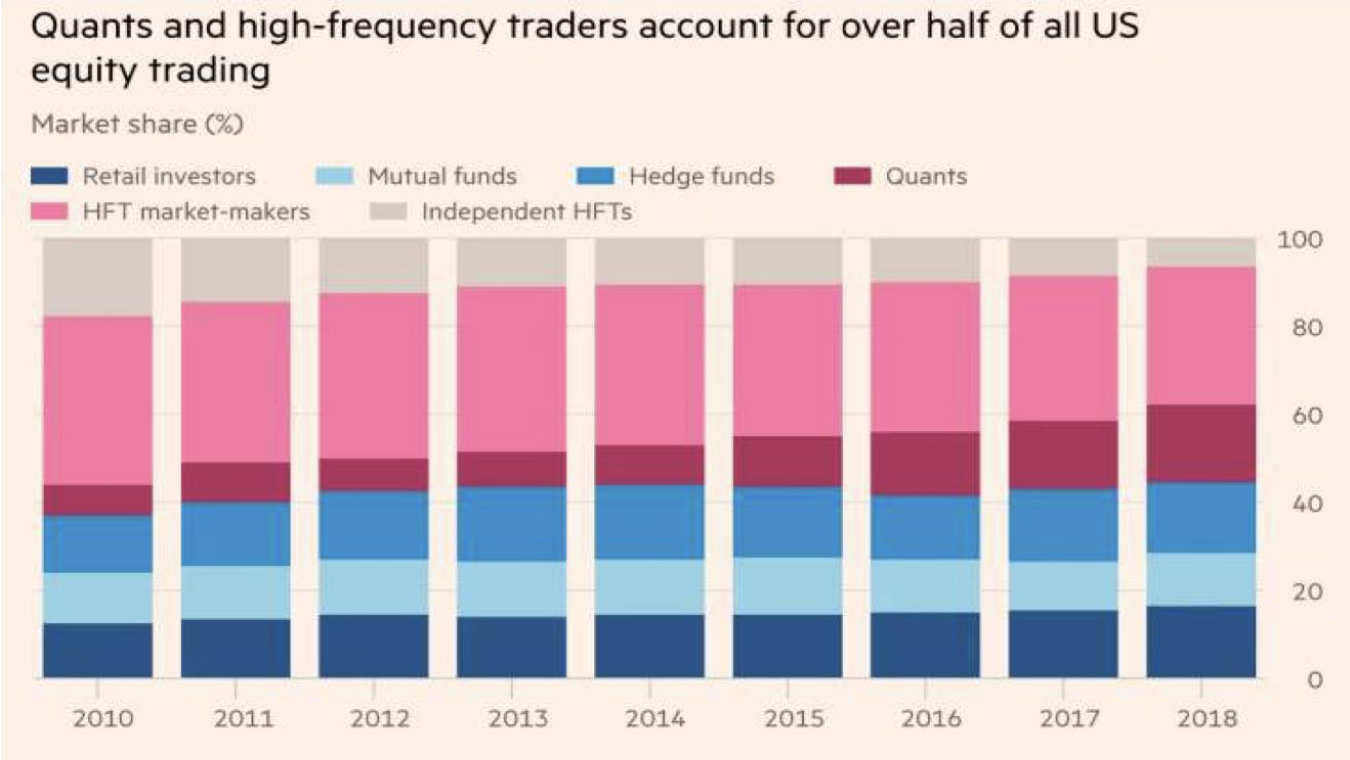
How much of the US stock
Market is algorithmic traded?



The advantages outweigh the risks

How much of the US stock Market is algorithmic traded?

- Algo trading constitutes **60-75%** of total trading volume on the US stock market



What high-level strategies are used in industry?

Example strategies

Statistical Arbitrage

- Exploits price inefficiencies between correlated instruments by maintaining a market neutral position - going long on undervalued and short on overvalued assets

Global Quant Macro

- Focused on analyzing large datasets and generating strategies based on economic and market indicators, across various asset classes

Example strategies

Market Making

- Market making strategies includes broadly, trading strategies profit by providing liquidity to other traders, while avoiding accumulating a large net position in a stock

Multi-Strat

- Multi-strategy hedge funds are investment vehicles that employ a variety of strategies to generate returns, reducing risk by diversifying their approaches.

A brief look forward

Next week and beyond

Moving away from the high-level picture and delving into the theory behind **basic strategies**:

- Mean reversion
- Arbitrage
- Pairs trading

Course Syllabus

L1 – Introduction and the basics of algorithmic trading

L2 – Creating and assessing trading algorithms

L3 – Portfolio Optimisation

L4 – External industry lecture

L5 – Machine learning in algorithmic trading

L6 – Options

L7 – External Industry lecture

L8 – The role of impact

Python notebook