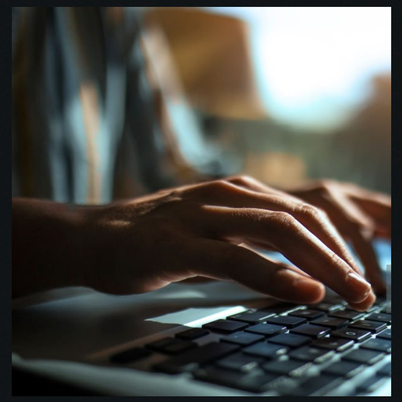
Financial Markets & Data

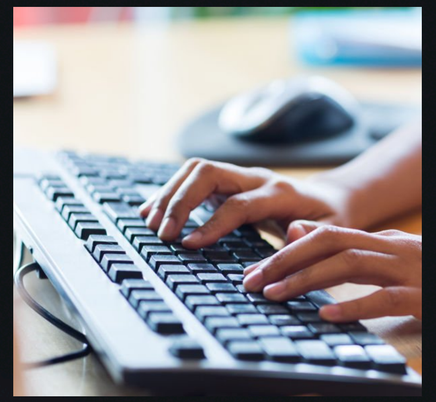
Basics of Algorithmic Trading: Lesson 1

ICAPP Capstone Project on Basics of Algorithmic Trading using Numin

How Financial Markets Work



Buyers

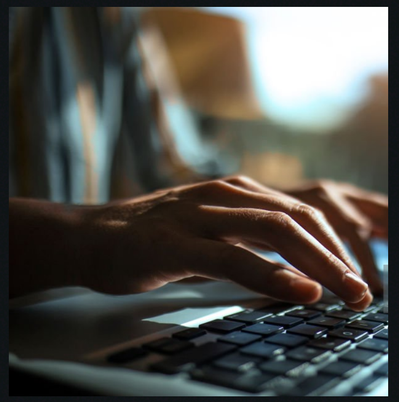


Sellers

Stock Exchange

How Financial Markets Work

Consider a single tradable instrument e.g. some company's stock



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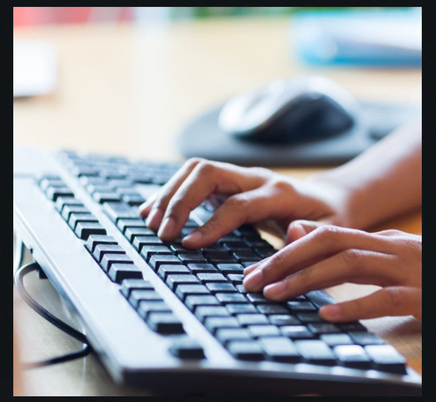

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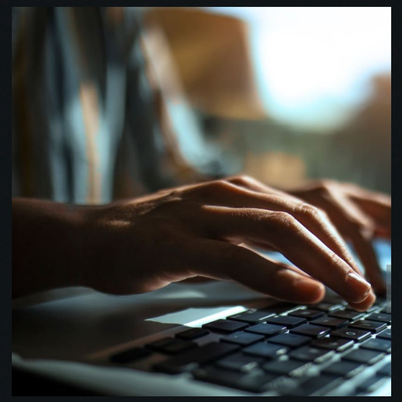
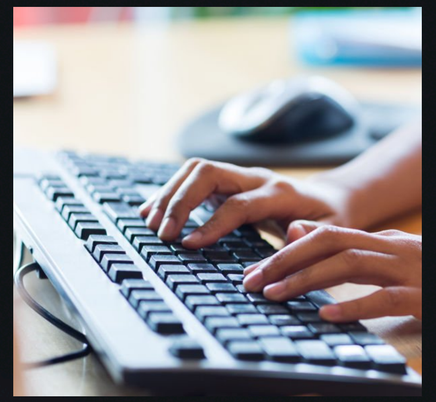


Buyers

buy 95 ⟶



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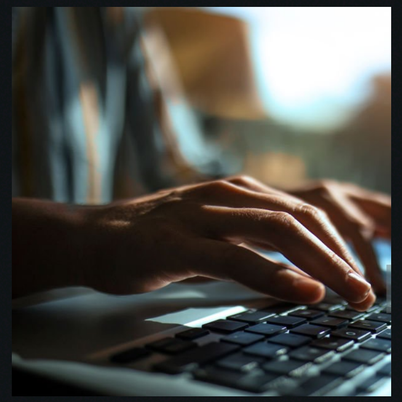
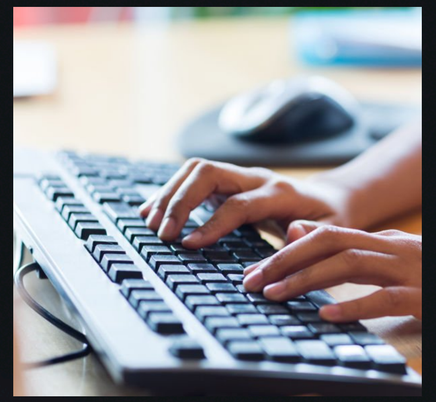


Buyers

sell 103

buy 95



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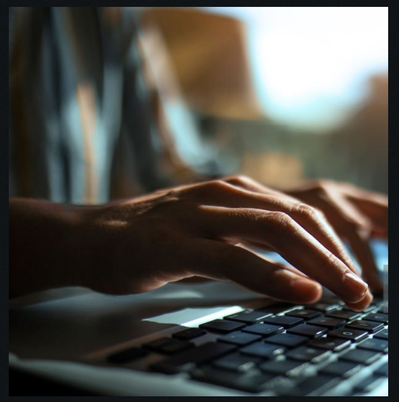
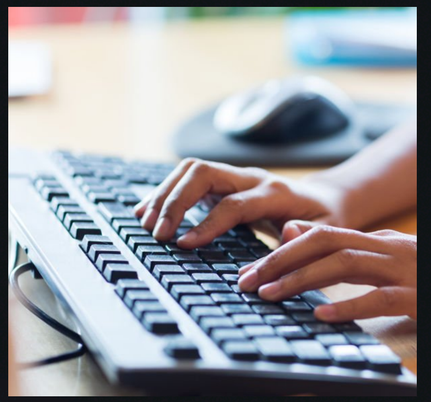


Buyers

buy 95 ⟶

⟵ sell 103

⟵ sell 101



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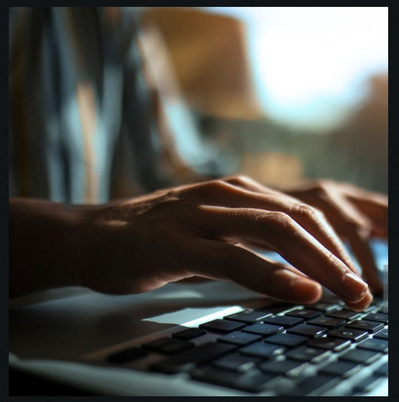


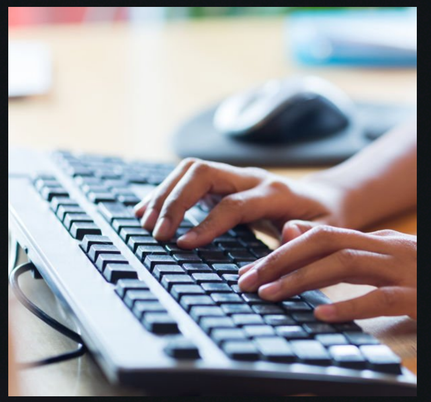
Buyers

sell 103

sell 101

buy 98

buy 95



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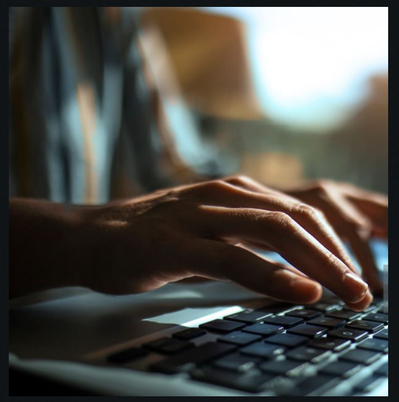

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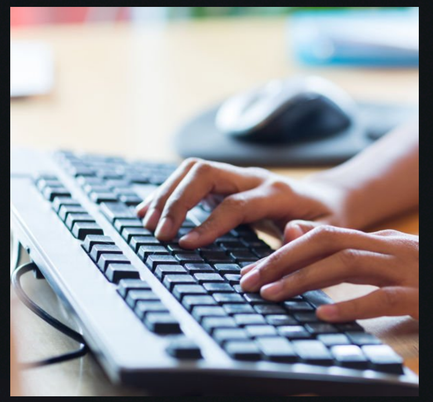

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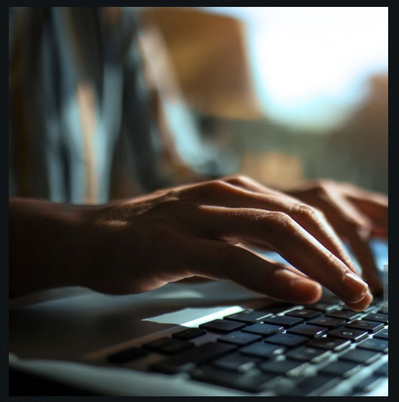

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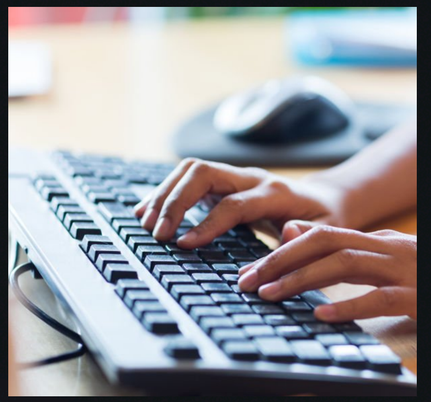
sell 101

buy 100 → ← sell 100

buy 98 →

buy 95 →



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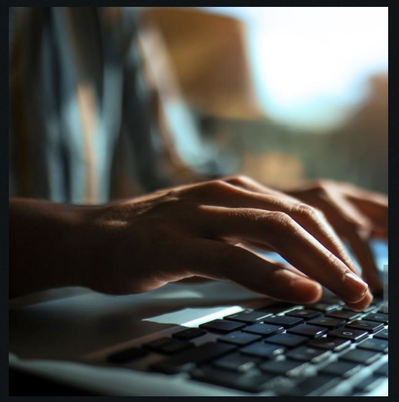


Buyers

sell 103

sell 101

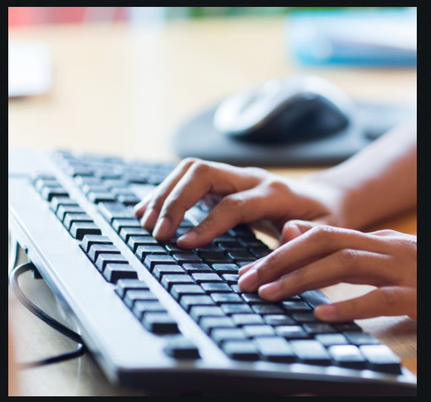
buy 100 → ← sell 100

buy 98 →

buy 95 →

trade @ 100

Stock Exchange



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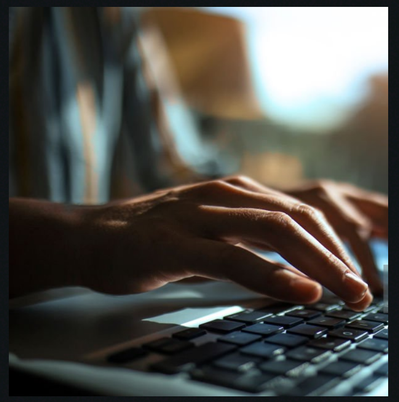


Buyers

buy 100

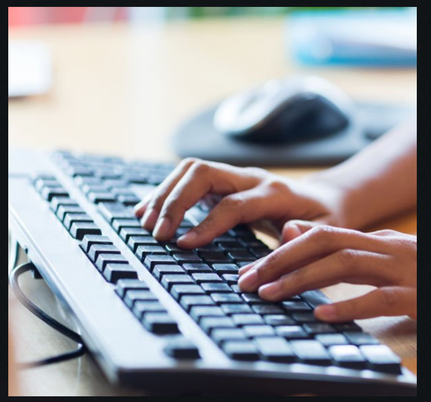
buy 98

buy 95

sell 103

sell 101

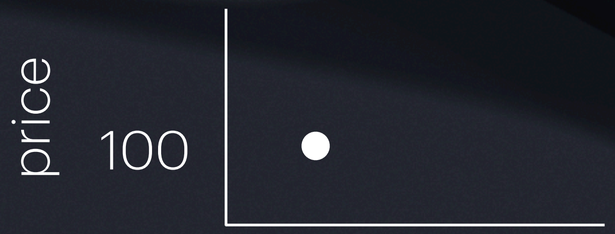
sell 100



Sellers

trade @ 100

Stock Exchange



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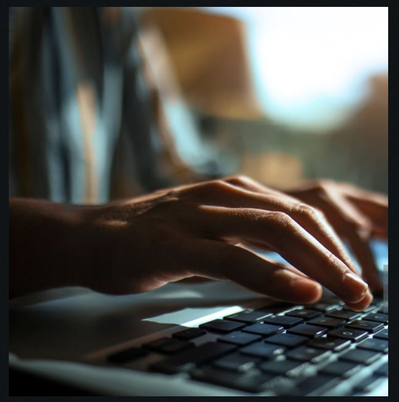


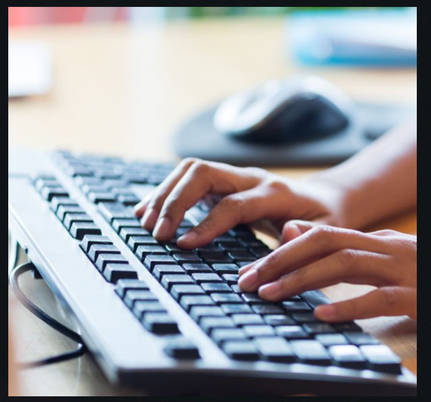
Buyers

buy 99 ⟶

~~*buy 95*~~ ⟶

⟵ sell 103

⟵ sell 101



Sellers

price

100

Stock Exchange

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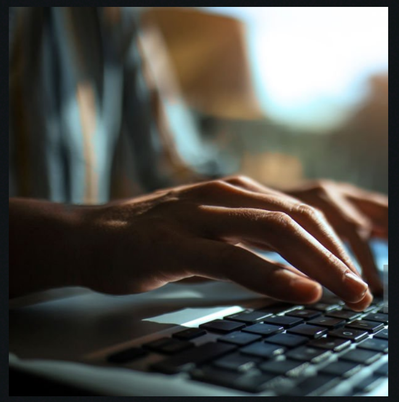


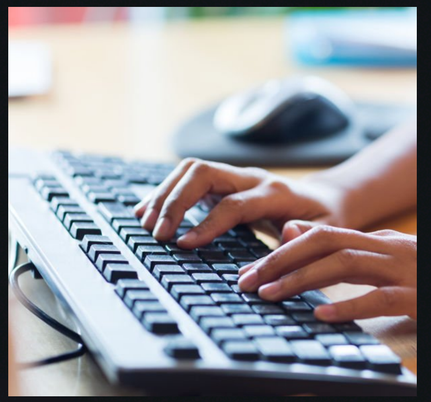
Buyers

sell 103

buy 101 → ← sell 101

buy 99 →

~~buy 95~~ →



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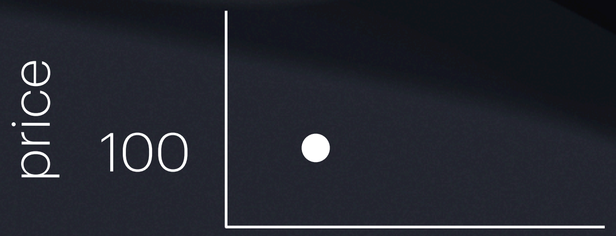

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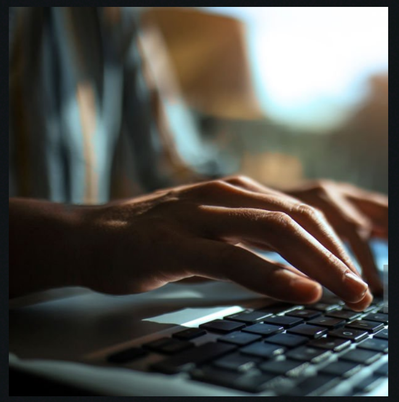

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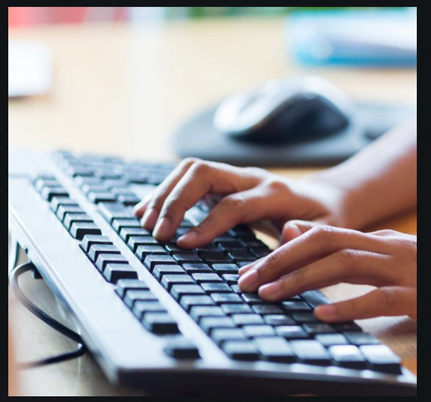
trade @ 101



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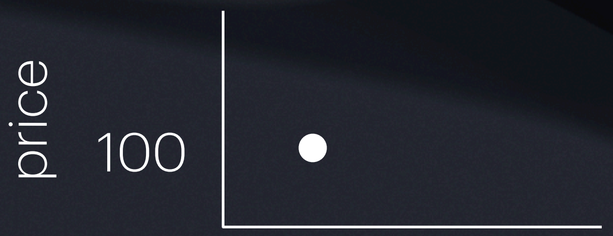

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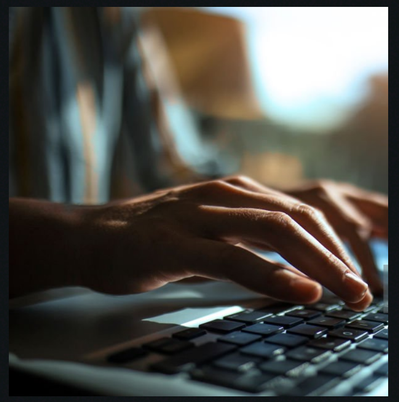

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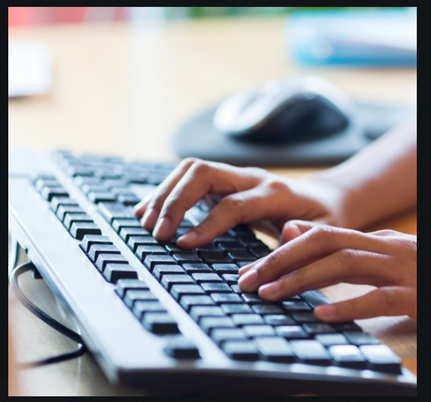

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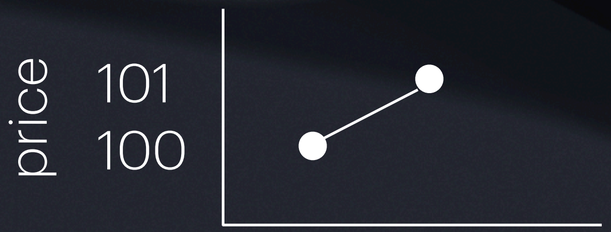

Market Data

Trade Data, Order Book, and OHLCV Data

Trade/Order Data

Timestamp

Symbol: e.g. APPL

Type:

LIMIT / TRADE / MARKET

Price

Buy/Sell

trade @ 100

Order Book

Timestamp, Symbol

LTP (last traded price)

Ask_0 ... Ask_20 (low->high)

Bid_0 ... Bid_20 (high->low)

BidQ_0 ... BidQ_20

AskQ_0 ... AskQ_20

sell 103
sell 101
sell 100
buy 100
buy 98
buy 95

OHLCV (Candles)

*e.g. in a **5 minute** interval*
(or even 1 second interval)

Timestamp, Symbol

Open

High

Low

Close

Volume

OHLCV Data: A closer look

Candles, Cross-sectional Data, Technical Indicators

Red (down) candle, i.e. close < open

Green (up) candle, i.e. close > open

OHLCV Data: A closer look

Candles, Cross-sectional Data, Technical Indicators

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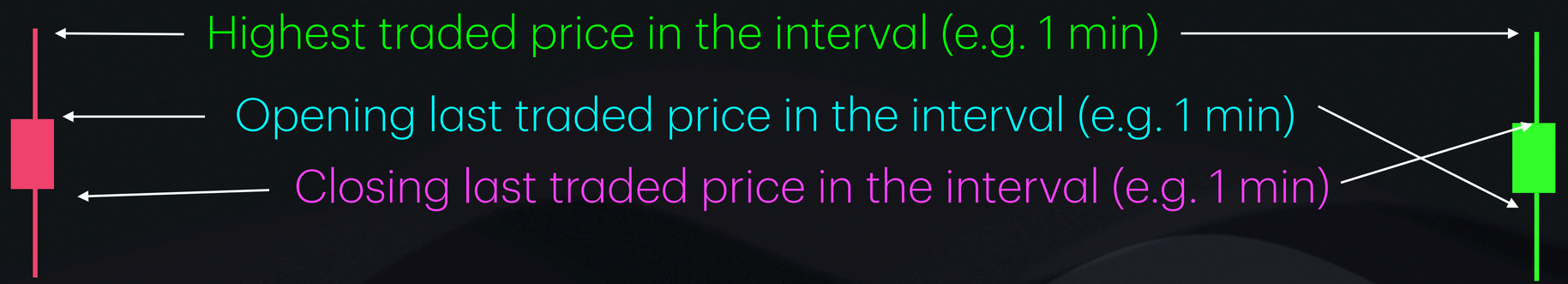

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OHLCV Data: A closer look

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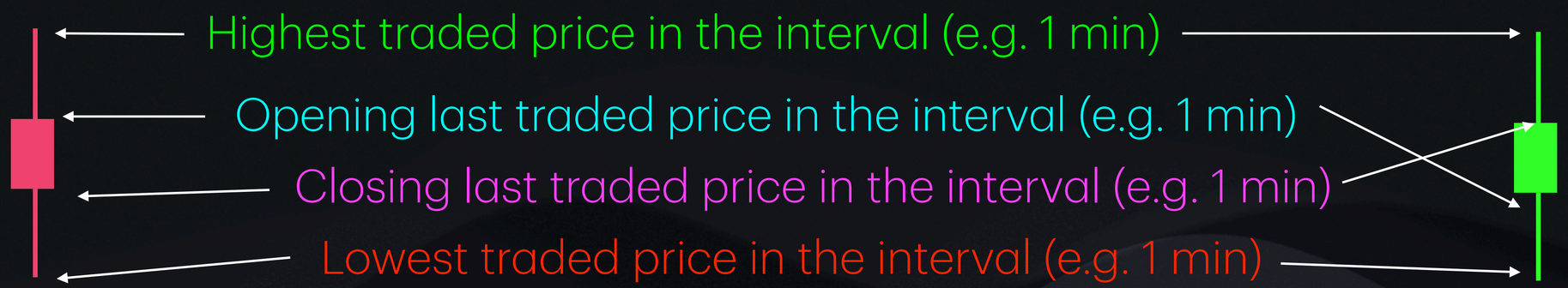

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OHLCV Data: A closer look

Candles, Cross-sectional Data, Technical Indicators

OHLCV Data: A closer look

Candles, Cross-sectional Data, Technical Indicators

- Cross-sectional data: OHLCV, … data for multiple stocks, or in general ‘tickers’

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- **Technical indicators**: e.g. moving average of closing prices over past m candles, etc.
  Crossing of longer and shorter moving averages indicates trend reversal

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OHLCV Data: A closer look

Candles, Cross-sectional Data, Technical Indicators

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- **Technical indicators**: e.g. moving average of closing prices over past m candles, etc. Crossing of longer and shorter moving averages indicates trend reversal

- A variety of other technical indicators are used in practice:
  - Bollinger bands: 2 standard deviations above and below the 20-candle moving avg; indicates volatility of the price movement, i.e. if these are wide then volatility is high
  - Relative strength index (RSI): % of average positive returns (over 14 candles); high RSI of over 70 indicates over-bought and low RSI of under 30 indicate over-sold

Next: The NUMIN Platform