PROJECT 1: backtesting moving average crossover strategy.

(part of the code was generated using AI. this project is not a showcase project but more of a project to learn and show something for it. As time passes, reliance on AI for code generation will be reduced. This is not financial advice.)

There is a lot of movement (and manipulation) in the stock market. How do we know when is the best time to enter or exit the market? How do we make sense of the general direction or the 'vibes' the market is headed towards? How do we make sense with so much motion and volatility?
To deal with all of this, we use moving averages.

What is moving average?
A moving average is a statistical method that **smooths** out short-term fluctuations in data by taking the average of the last *n* observations.
In this project, we use simple moving averages and exponential moving averages.

In financial markets, data is noisy (prices jump randomly minute-to-minute). Traders use moving averages to:
- Identify trend direction.
- Support & resistance: MAs often act as "psychological levels" where traders buy/sell.

So, we take the average of X days and Y days and compare and perform actions based on their intersections and relative motions.
One of the most famous trading strategies is called the golden cross vs the death cross.

Golden cross: When the short-term moving average (e.g., 50-day) crosses **above** the long-term moving average (e.g., 200-day).
This means:

● Short-term momentum is turning positive.
● Price is gaining strength relative to its long-term trend.
● Often viewed as the start of a **bull market**.

Death cross: When the short-term moving average crosses **below** the long-term moving average.
This means:

● Short-term weakness is overtaking long-term momentum.
● Price trend is weakening → potential start of a **bear market**.

In this project we did 3 such experiments.

1. Simple moving average with 50-200 days as time span.
2. Exponential moving average with 25-50 days as time span.
3. Exponential moving average with 50-200 days as time spans.

This was our strategy:

See on what days, MA50 was greater than MA200. Assign 1 to those days when it was true and 0 when it was false.

Now realistically, we know the verdict of the above statement only at the end of the day (simply because we built our model using the closing prices of the day) so we operate on the knowledge of the previous day's verdict.

We can either buy/sell/stay at the current position (i.e. hold equity or cash).

```
data['Cumulative_Market'] = (1 + data['Return']).cumprod()  #cumprod
means compound product. ie 1 dollar is invested just compounded over
time.

data['Cumulative_Strategy'] = (1 + data['Strategy_Return']).cumprod() #
1 dollar is invested as per the strategy. so if yesterdays signal was 0
we do not earn anything.
```

We place 2 bets. One where we just buy and hold (cumulative_market) and the second being ours where we are only "buying" when the signal flips from 0 → 1, and "selling" when it flips from 1 → 0. **holding the stock (if signal = 1), or sitting in cash (if signal = 0).**

Before we just to the results, lets answer a few questions:

Why 50-day and 200-day?

- **50-day MA** → captures the **medium-term trend** (about ~2–2.5 months of trading days).
- **200-day MA** → captures the **long-term trend** (~10 months of trading days).
- These are widely followed by institutional investors and hedge funds, so they become **self-fulfilling signals**: if many people act on a 50/200 crossover, price tends to react!!!!

What if 15 days (shorter periods)?

- A **15-day EMA/SMA** reacts much faster to price moves.
- This means it can **catch early trend changes**, but also gives a **lot more false signals** because short-term price noise (volatility, daily fluctuations) dominates.

Shorter MA (e.g., 10–20 days): Fast signals, higher sensitivity, but more whipsaws (false buy/sell).

Longer MA (e.g., 100–200 days): Slow signals, fewer false signals, but you may miss the beginning of a trend.

In **Nifty 50**, historically, the price rarely stays more than **15–17% above the 50DMA**. So, if it is more, it may be time to be cautious and to get ready to sell.

Here is an example:

Day 0: Short MA below Long MA → No trade (bearish trend).

Day 20: Short MA crosses above Long MA → **Buy** at $100.

Day 80: Stock rises to $140, MAs stay bullish → still holding.

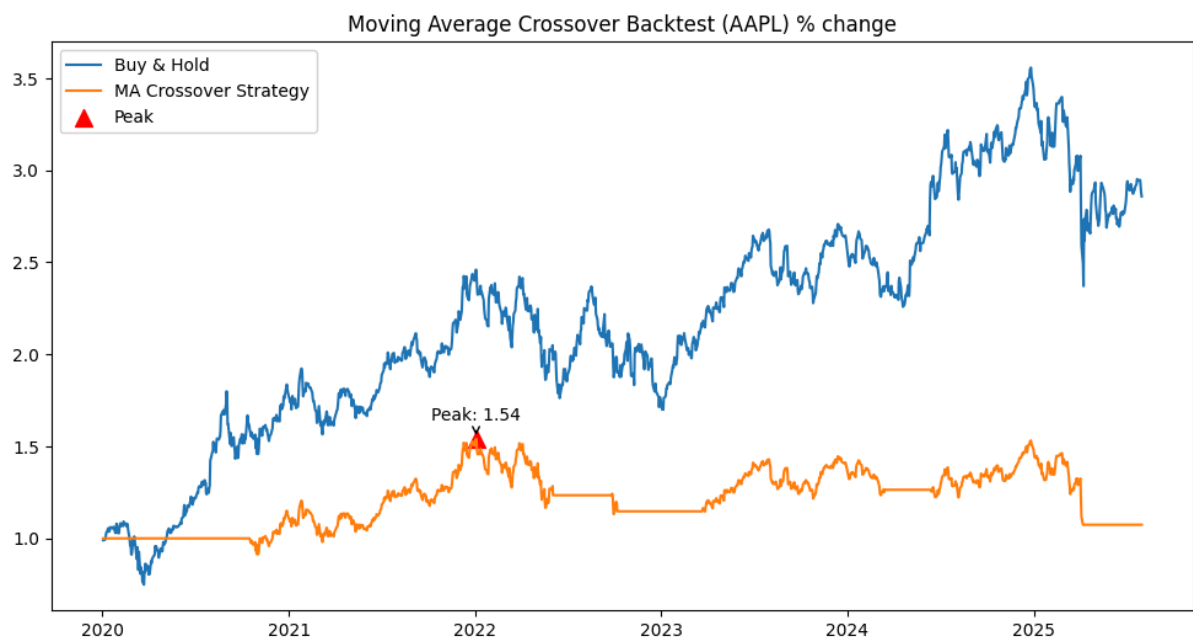**Day 150**: Short MA crosses below Long MA → **Sell** at $130.

Profit: $30/share.

Lets proceed to the result now:

Fig 1: Simple moving average with 50-200 DMA
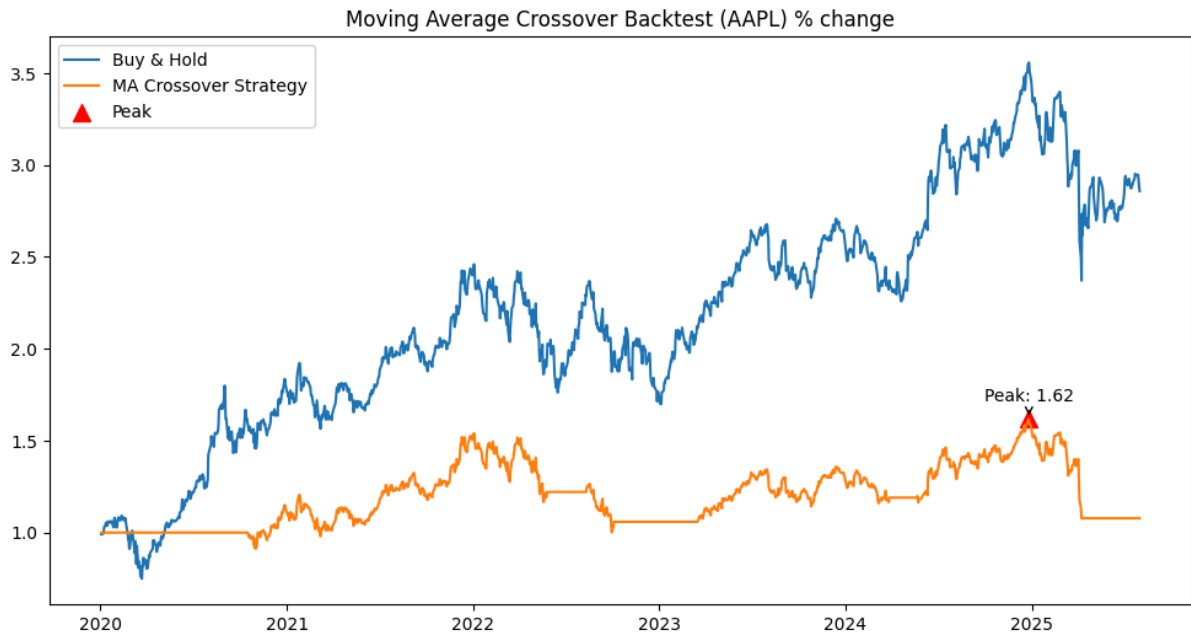
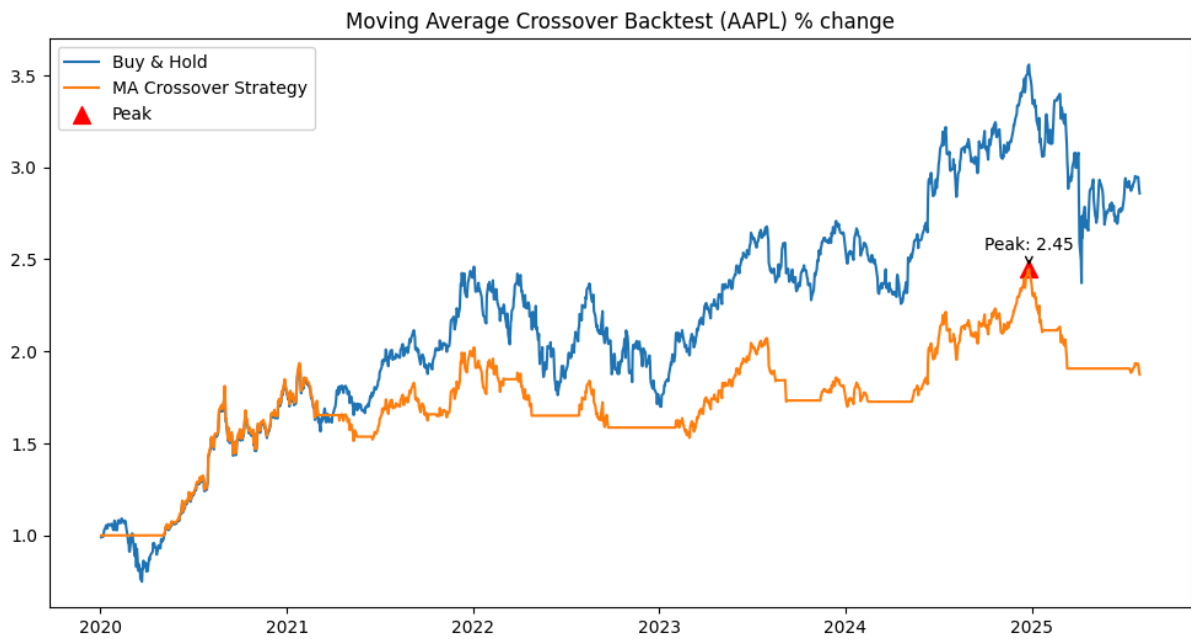Fig 2: Exp. moving average with 50 200 DMA

Fig 3: Exp. moving average with 25-50 days MA.

Which clearly shows, investing and forgetting about it clearly outperformed our strategy by at least 1.5 times.

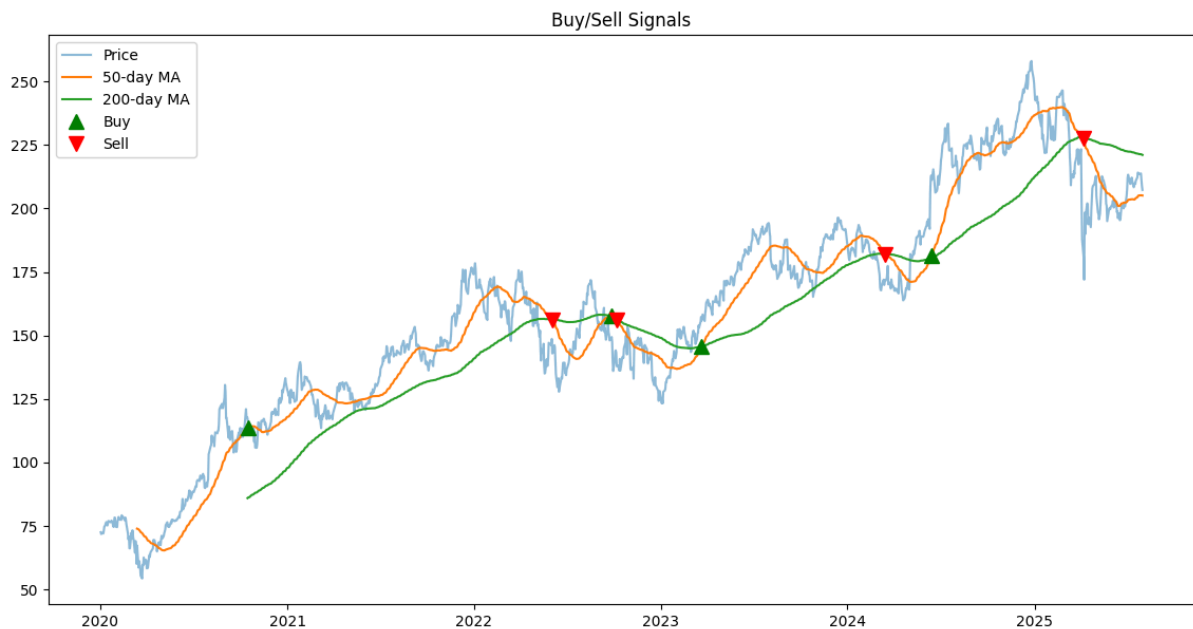I shall be implementing this on 3-4 nifty50 shares as well in the future.

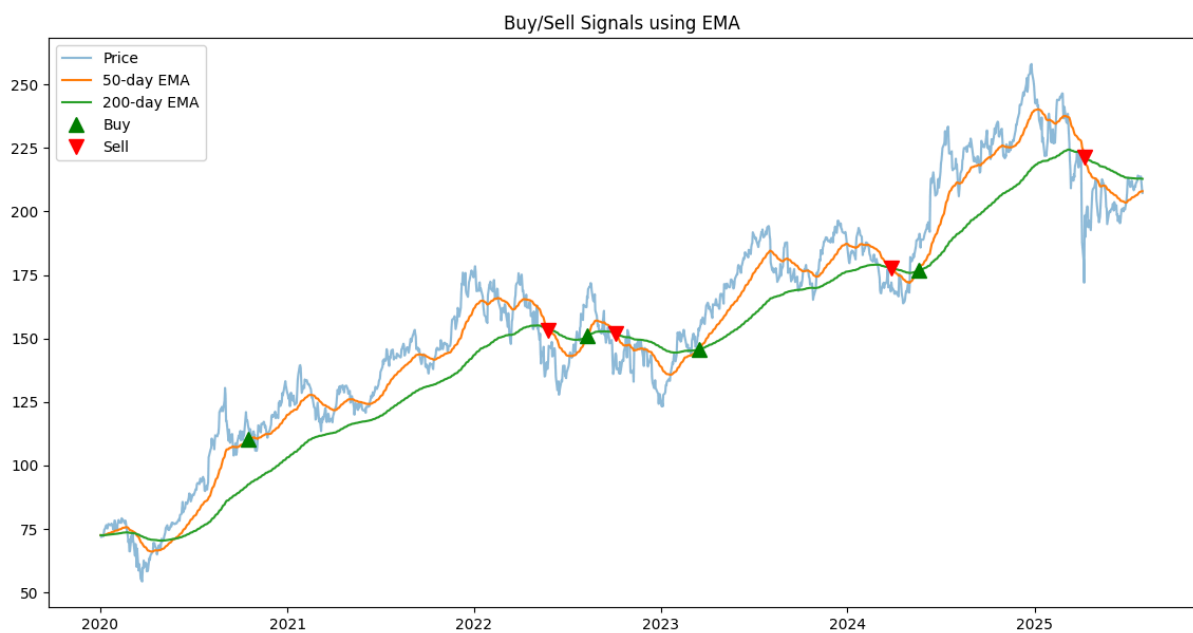Fig 4: BUY/SELL graph we got from simple moving average.

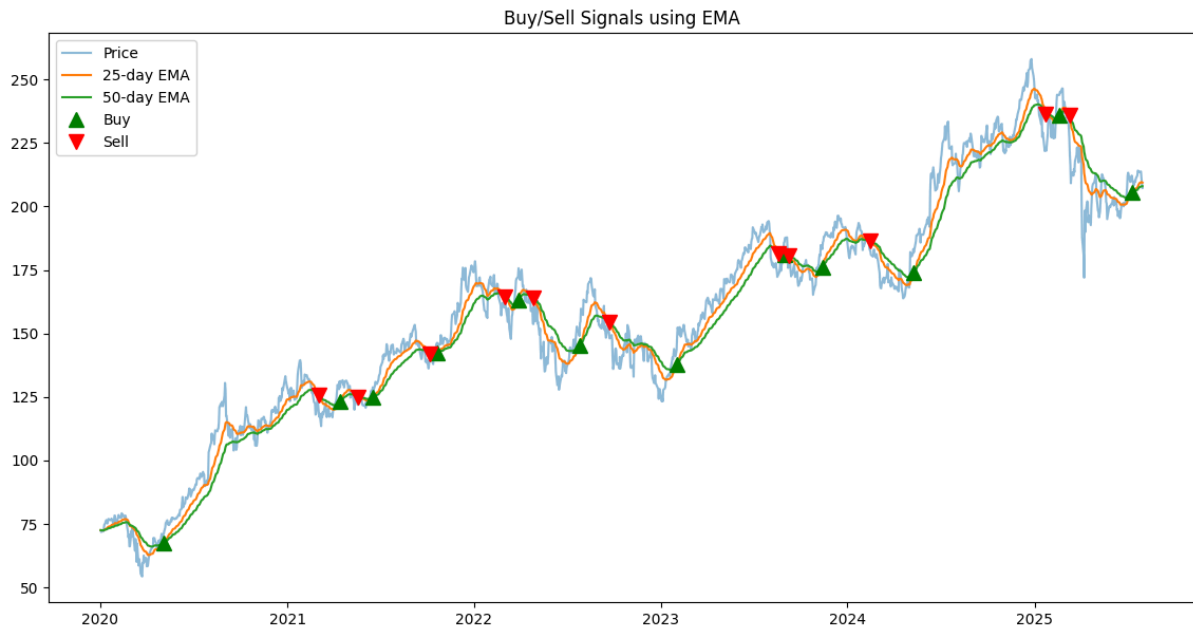Fig 5: BUY/SELL graph we got from exp.moving average 50-200 DMA.

Fig 6: BUY/SELL graph we got from exp.moving average 25-50 DMA. (more opportunities).

Note:

These strategies are more about risk management than raw returns. During prolonged bear markets, MA crossover systems can prevent large drawdowns. Markets trend upward over decades due to growth, inflation, and compounding. Staying invested usually beats timing-based strategies—unless risk reduction is the goal.