Question 2.2 solution:

1. Data used

- BTC-USD
- **Period:** 01-01-2022 to 01-01-2025
- **Frequency:** Daily
- **Source:** yFinance

2. Technical Indicators

- **Momentum:** Ichimoku Cloud (9-26-52)
  - Lower Tenkan (5–7): very noisy signals
  - Higher Tenkan (12–15): delayed momentum

  Parameter Experimentation Insight

  - Best balance observed at **(9, 26, 52)**, consistent with TradingView defaults and class demonstrations

- **Volume:** Ease of Movement (14-period smoothing)
  1. High EOM → price moves easily (low resistance)
  2. Low EOM → price faces strong resistance

  Parameter Experimentation Insight

  - Period < 10 → erratic oscillations
  - Period > 20 → late signals
  - **14** provided optimal smoothness vs responsiveness

- **Volatility:** Keltner Channels (EMA-20, ATR-10, multiplier 2)

  Parameter Tuning Summary

  - Multiplier < 1.5 → excessive false signals
  - Multiplier > 2.5 → missed breakouts
  - **(20, 10, 2)** gave best visual and statistical behavior

3. Signal Generation (defined rules)

Buy: price above cloud, EOM positive, price above UpperKC

Sell: price below cloud, EOM negative, price below LowerKC

A Signal column and Position column are included in the dataset.

4. Risk Management

Simple 5% stop-loss and 10% take-profit from entry price.

5. Backtesting Framework on intial capital of 1,00,000

- Strategy returns vs Buy-and-Hold
- Equity curve comparison
- Position-shifted returns (no look-ahead bias)
- Final Portfolio Value: 221205.63
- Net Profit: 121205.63

6. Performance Metrics (@1% annual risk-free, daily)

- Sharpe ratio = 0.96
- sortino ratio = 0.89
- maximum drawdown= -21.33
- Winning trades,loosing trades,win rate = 56.52 %

7. Optimization Discussion

- EMA length sensitivity
- Stop-loss tuning (3%, 5%, 8%)
- Suggestions for further improvement (position sizing, RSI filter)

Reference platform for parameter behavior: **TradingView**