Technical Report:

Mean Reversion Trading Strategy on Indian Equities (HCLTECH.NS)

Introduction:

This report presents the design, implementation, and backtesting of a quantitative mean reversion trading strategy on HCL Technologies (HCLTECH.NS) in the Indian stock market. The strategy utilizes the statistical principle of price reverting to the mean using the Z-Score of the closing price over a rolling window to produce trading signals. The assessment adheres to the guidelines and deliverables outlined in the problem statement, such as code implementation, technical description, and performance metrics.

Strategy Logic and Rationale :

The mean reversion hypothesis takes for granted that asset prices will revert to historical mean in the long run. We calculate the mean and standard deviation of the closing price based on a 20-day rolling window in this strategy. The Z-Score measures how many standard deviations the current price deviates from the rolling mean.

Signal Generation:

Buy Signal: When Z-Score < -1 (price far below the mean, expecting a reversion up)
Sell Signal: When Z-Score > 1 (price far above the mean, expecting a reversion down)
Neutral/Carry Forward: Positions are forward-filled to continue exposure until a reversal signal is generated.

Indicators Used:

20-day Simple Moving Average (SMA) and Standard Deviation
Z-Score as the main signal indicator

Explanation:

This method is easy to implement yet robust for measuring short-term price abnormalities in mean-reverting stocks. The Z-Score limits (-1, +1) are conventional to identify statistically significant variation, striking a balance between trade frequency and noise elimination.

Implementation Details

Data Source: Yahoo Finance through yfinance Python library
Time Period: January 1, 2018 – December 31, 2023
Framework: Python script using pandas, numpy, and matplotlib for analysis and visualization

Execution Logic:

Positions are refreshed every day using the Z-Score.
Returns are computed as daily percentage returns on closing price times yesterday's position.
The equity curve follows the aggregate capital over time.

Equity Curve and Performance

- The equity curve shows the evolution of strategy capital over time. The curve peaked around 2020 but experienced a prolonged decline thereafter, indicating periods of underperformance and drawdown[3].
- The Z-Score plot visualizes entry/exit thresholds and the frequency of signals.
- The price chart overlays buy (green triangles) and sell (red triangles) signals on the actual price series, illustrating the timing and clustering of trades.