**1. Strategy Overview**

**Strategy Concept**

This report evaluates a **Z-Score Mean Reversion Strategy** applied to Indian stocks (e.g., NSE-listed equities). The strategy is based on the statistical principle that asset prices tend to revert to their historical mean after extreme deviations.

**Why Mean Reversion?**

* Works well in **range-bound markets** (common in sideways or consolidating phases).
* Statistically grounded (**Z-Score** measures how far price deviates from its mean).
* Suitable for **highly liquid stocks** (like large-cap NSE equities) where mean reversion is observable.
* **Choice of Indicators & Statistics**

| **Indicator** | **Purpose** | **Rationale** |
| --- | --- | --- |
| **Z-Score** | Measures deviations from the mean | Identifies overbought/oversold conditions statistically. |
| **Rolling Mean (SMA-20)** | Benchmark for "fair price" | Smooths out noise to define the mean. |
| **Rolling Std Dev** | Normalizes price deviations | Ensures strategy adapts to changing volatility. |
| **Bollinger Bands (Optional)** | Visual overbought/oversold levels | Confirms Z-Score signals with price action. |

**2. Strategy Logic**

**Entry Conditions**

* **Buy (Long):** When Z-Score < -2 (price is **2 standard deviations below mean**, oversold).
* **Sell (Short):** When Z-Score > +2 (price is **2 standard deviations above mean**, overbought).

**Exit Conditions**

* **Close Long:** When Z-Score ≥ -0.5 (price returns near mean).
* **Close Short:** When Z-Score ≤ +0.5 (price returns near mean).

**Risk Management**

* **Stop-Loss:** Implicit via Z-Score threshold (if price keeps deviating, exit).
* **Position Sizing:** Fixed fractional (e.g., 10% of equity per trade).

**3.Key Metrics (Example Values)**

*(Note: Actual numbers will be printed by results when run)*

| **Metric** | **Value** |
| --- | --- |
| Total Return | X% |
| Annualized Return | Y% |
| Max Drawdown | -Z% |
| Win Rate | W% |
| Number of Trades | N |
| Sharpe Ratio | S |

**❖ Interpretation:**

* **Positive Total & Annualized Return** suggests profitability.
* **Max Drawdown** indicates risk exposure — should be within acceptable limits.
* **Sharpe Ratio > 1** implies risk-adjusted performance is decent.
* **Win Rate** provides insight into trade accuracy; higher than 50% is good for a mean reversion model.

**4. Visualizations**

Your code generates:

**a) Equity Curve**

Shows portfolio value growth over time.  
**Interpretation**: A steadily rising curve indicates consistent profitability.

**b) Drawdown Curve**

Shows peak-to-trough declines from previous highs.  
**Interpretation**: Highlights periods of significant losses.

**c) Price Chart with Trading Signals**

* **Price Line**: Closing prices.
* **Upper/Lower Bands**: ±2 std dev from mean.
* **Buy (↑)**: When price crosses below lower band.
* **Sell (↓)**: When price crosses above upper band.

**Interpretation**: Visual check of signal timing and market conditions during trades.

**5. Code Design Choices**

* **Why 20-period lookback?**  
  Common default in statistical finance for mean-reversion (monthly scale for daily data).
* **Entry/Exit Z-Score Thresholds**  
  ±2 and ±0.5 chosen based on:
  + Typical overbought/oversold statistical boundaries.
  + Ensures trades are placed only on significant deviations and exited promptly.
* **0.1% Commission & 1x Leverage**  
  To reflect realistic trading costs and no margin influence on return

**6.Resources Used**

**Data Sources**

* **Yahoo Finance API (**yfinance**)** – For fetching NSE OHLCV data.
* **NSE Historical Data (Alternative)** – Manual CSV imports if needed.

**Python Libraries**

| **Library** | **Purpose** |
| --- | --- |
| backtesting.py | Backtesting engine |
| pandas | Data manipulation |
| numpy | Numerical computations |
| scipy.stats | Z-Score calculation |
| matplotlib | Visualization |