📊 CFA Induction Task Report

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📌 Strategy Overview

This is a **mean-reversion strategy** implemented in Python using the `backtesting.py` framework. It is tested on **Nifty 500 OHLC data from 1st Jan 2015 to 20th May 2025**. The core assumption is that prices tend to revert to their mean after deviating significantly. The strategy enhances this concept with signal smoothing, market neutralization, and statistical normalization.

⚙️ Logic Used

The signal is based on **Bollinger Band extremes**—when price crosses above or below the bands, it indicates potential reversion. However, the strategy doesn't react immediately. Instead, it:

- Accumulates bullish and bearish signal strength over a rolling window.
- Applies **decay weighting** to emphasize recent events.
- Neutralizes the signal against the market trend using **linear regression residuals**.
- Normalizes the result using a **z-score**.

✅ Buy Condition:

- Z-score of the final signal is **greater than 1**.
- No existing position.
- Allocate **20% of available equity** per trade.

❌ Sell Condition:

- If in a long position and z-score drops **below -1**, the position is closed.

📉 Stop Loss & Take Profit:

- ❌ **Not explicitly defined.**
- Exits are **signal-driven**, based on z-score thresholds.

📦 Indicators Used

- **Custom Bollinger Bands** (15-period rolling mean ± 1 std dev) on average price.
- **Signal Decay Function** (20-period linear decay).
- **Group Neutralization** against market trend using residuals.
- **Z-Score Normalization** (250-period).

💡 Position Sizing

- 20% of current **equity** is allocated per trade.

📈 Interpretation of Results

- **Sharpe Ratio:** ~1.02 – good risk-adjusted performance.
- **Max Drawdown:** ~-4.60% – suggests robust risk control.
- **Profit Factor:** ~2.889 – earned ₹2.89 for every ₹1 lost.
- **Total Return:** +26% – competitive returns with low volatility.
- **Alpha:** ~+5.05% – solid outperformance vs market.
- **Beta:** ~0.09 – strategy is mostly uncorrelated with the market.
- **% Time in Market:** ~47% – active without being overly exposed.

📊 Strengths

- 📌 **Multi-step signal refinement** filters out noise.
- 📌 **Market-neutral design** enhances stability across conditions.
- 📌 **Z-score normalization** makes the system adaptive.
- 📌 Minimal overfitting due to simple position sizing.

⚠️ Limitations

- ❗ No stop-loss could lead to large losses in extreme events.
- ❗ Lags during rapid reversals due to reliance on rolling windows.
- ❗ High complexity – more prone to bugs or data errors.
- ❗ No short-selling logic included.

📂 Resources

- `backtesting.py` – backtesting framework
- `numpy`, `pandas` – for numerical computation
- Nifty 500 CSV data (manually sourced)
- Visual chart generated with `bt.plot()`