YMS QR Assessment: Problem 2

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Core Philosophy

The strategy exploits the mean-reverting nature of the **Calendar Spread** ($Price_{FUT2} - Price_{FUT1}$) in the Indian derivatives market. Although individual futures prices are driven by directional beta and market sentiment, the spread represents the structural Cost of Carry(Interest rate differential minus Dividends). In a stable market regime, this cost is fundamentally bounded and mean-reverting, making it an ideal candidate for statistical arbitrage. By trading the spread, we neutralize the risk of the market direction and isolate the relative value between contracts.

Alpha Generation (Z-Score)

We calculate a rolling Z-Score of the spread over a **300-minute window** to capture intraday mean reversion opportunities:

$$Z = \frac{CurrentSpread - RollingMean}{RollingStdDev}$$

- **Entry ($|Z| > 2.0$):** We bet on convergence when the spread extends statistically beyond two standard deviations.
  - If $Z > 2.0$ (Expensive): **Short Spread** (Sell FUT2, Buy FUT1). We expect the spread to narrow.
  - If $Z < -2.0$ (Cheap): **Long Spread** (Buy FUT2, Sell FUT1). We expect the spread to widen back to the mean.
- **Exit ($|Z| < 0.5$):** We exit the position when the spread reverts to its mean (within 0.5 standard deviations), capturing the reversion profit.

Risk Management: Integration of Problem 1 Insights

Standard mean reversion models often fail during stress events or structural shifts. We applied strict, data-driven filters derived from our Exploratory Data Analysis (EDA) in Problem 1 to remove specific structural risks:

Regime Filter *[Insight from Problem 1C]:* We observed that specific stocks (e.g., SHREECEM) exhibit extreme "fat tail" volatility (StdDev > 40.0) and deep backwardation that defy normal statistical bounds. **Action:** We blacklist any stock with a spread StdDev > 25.0. This successfully removes chaotic "Regime B" stocks from the trading universe, significantly reducing maximum drawdown and tail risk.

Execution Window *[Insight from Problem 1B]:* The Volume Ratio ($FUT2/FUT1$) spikes exponentially from 0.2 to > 2.0 in the final 48 hours before expiry. This liquidity fragmentation causes bid-ask spreads to widen and impact costs to soar.
Action: We strictly trade only in the **DTE [2, 7]** window. Positions are forced closed if Days to Expiry (DTE) drops below 2 to avoid expiry Gamma risk and high transaction costs during the rollover shuffle.

Liquidity Filter To ensure reliable execution simulations and avoid slippage on thin names, we exclude names with a Median Minute Volume < 500 lots.

Execution Assumptions

To ensure the backtest remains realistic and conservative:

- **Position Sizing:** 1 Lot per leg (Spread Unit) to normalize risk across different tick sizes.
- **Costs:** Conservative estimates applied to the full notional value of both legs:
  - Commission: 0.5 bps
  - Slippage: 1.0 bps