Market Making Challenge (UAT Live Edition)

Problem Statement + Baseline + Submission + Evaluation

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In partnership with Fintech Club, IIT (ISM) Dhanbad

Problem Statement (What You Build)

- Build a **simulated market-making strategy** using **live UAT market data**.
- Instrument for market making: **NIFTY Options** with **expiry date: 6 January 2026**.
- At each step, read **best bid/ask** and **volumes** from the order book.
- Compute quotes (your bid/ask), simulate fills, and track **inventory + PnL**.
- Your strategy must:
  - **Adapt spread** based on order-book imbalance
  - Apply **inventory-based skew** to control risk
  - **Benchmark** performance vs a naive constant-spread baseline

4.1 Data You Will Use (Live Order Book)

- Inputs from market at time t:
  - Best bid b_t, best ask a_t
  - Volume at best bid V_t^{bid}, volume at best ask V_t^{ask}
- Supply–demand intuition:
  - Higher bid volume $\Rightarrow$ stronger demand
  - Higher ask volume $\Rightarrow$ stronger supply
  - Spread $(a_t - b_t)$ reflects liquidity/uncertainty

4.2 Quoting Logic (Mid + Base Spread)

- Mid price:

$$m_t = \frac{b_t + a_t}{2}$$

- Base spread (tick-based):

$$s_0 = 2 \times \text{tick\_size}$$

- You must quote both sides:

$$\hat{b}_t = m_t - \frac{s}{2}, \quad \hat{a}_t = m_t + \frac{s}{2}$$

- Always enforce: $\hat{b}_t < \hat{a}_t$ and round to tick size.

4.3 Dynamic Spread (Order-Book Imbalance)

- Imbalance signal:

$$I_t = \frac{V_t^{bid} - V_t^{ask}}{V_t^{bid} + V_t^{ask}} \in [-1, 1]$$

- Adaptive spread rule (simple version):

$$s_t = s_0\big(1 + \alpha |I_t|\big)$$

- Intuition:
  - $|I_t|$ small $\Rightarrow$ tighten spread (more liquidity)
  - $|I_t|$ large $\Rightarrow$ widen spread (higher adverse-selection risk)

4.4 Inventory-Based Skew (Risk Control)

- Inventory = your position:

$$Q_t \text{ (units or lots)}$$

- Goal: keep inventory near zero; cap it:

$$|Q_t| \leq Q_{\max}$$

- Skew rule:

$$\hat{b}_t = m_t - \frac{s_t}{2} - kQ_t, \quad \hat{a}_t = m_t + \frac{s_t}{2} - kQ_t$$

- Intuition: *If I'm long, I want to sell faster. If short, buy faster.*

4.5 Fill Simulation (L1 Rules)

- Simple deterministic fill rules:
  - If $\hat{b}_t \geq a_t \Rightarrow$ buy fill at a_t
  - If $\hat{a}_t \leq b_t \Rightarrow$ sell fill at b_t
- Update state (unit size):

$$\text{Buy: } Q_t \leftarrow Q_t + 1,\ C_t \leftarrow C_t - a_t \qquad \text{Sell: } Q_t \leftarrow Q_t - 1,\ C_t \leftarrow C_t + b_t$$

- Mark-to-market PnL:

$$\text{PnL}_t = C_t + Q_t \cdot m_t$$

- Simulation is used to focus on **strategy logic**, not exchange execution systems.

5. Baseline Strategy (Benchmark)

- Baseline = constant-spread quoting:

$$s^{base} = s_0, \quad \hat{b}_t^{base} = m_t - \frac{s_0}{2}, \quad \hat{a}_t^{base} = m_t + \frac{s_0}{2}$$

- Baseline has:
  - No imbalance awareness
  - No inventory skew
- Benchmarking is mandatory:

$$\text{PnL}^{adaptive} \text{ vs } \text{PnL}^{baseline}$$

7. Deliverables & Submission (GitHub Repo)

- Submit a GitHub repo containing:
  - Code / notebook (runs the live UAT session)
  - CSV logs (timestamps, bid/ask, inventory, PnL, baseline PnL)
  - Plots (PnL curves, inventory curve; adaptive vs baseline)
  - Short explanation (README: strategy, parameters, assumptions)

What Judges Look At

- **PnL curves:** adaptive vs baseline (same time window)
- **Inventory stability:** bounded inventory, no runaway drift
- **Strategy clarity:** explain spread & skew logic + parameters

8. Evaluation Criteria (Scoring)

Category	Points
PnL improvement vs baseline	40
Inventory control (cap + stability)	20
Responsiveness (imbalance + skew behavior)	20
System stability (no crashes, clean logs)	10
Quality of analysis & visualization	10

- Strong submissions show **outperformance with risk discipline**.