

# Chicago Quant Alley

## Assignment 2

Build a Quantitative Strategy Simulator from Scratch

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### 1. Overview

This assignment implements a modular backtesting engine for intraday options strategies, particularly focused on short straddles. The system includes:

- **Simulator:** Executes the core trading loop using market data.
- **Strategy:** Contains the decision logic for when to enter and exit trades.
- **PrintStats:** Analyzes output data such as P&L and generates metrics and plots.

### 2. Simulator Module

The `Simulator.py` module emulates a trading environment for options strategies. It performs the following:

- Loads historical options data and futures price series.
- Simulates trade execution with slippage.
- Tracks portfolio quantities, turnover, and realized/unrealized PnL.
- Logs each trade with timestamp, symbol, quantity, and price.

**Key Feature:** The simulator supports modular strategy injection, allowing any strategy class with an `onMarketData` interface to interact with the engine.

**Note:** Always use `drop_duplicates` on `pnl_history` before saving CSVs to avoid timestamp clutter in plots.

### 3. Strategy Module

The `Strategy.py` contains a simple intraday short straddle strategy:

- Entry at 13:00 using ATM call and put options.
- Exits when deviation in futures crosses 1% or if net PnL breaches  $\pm 500$ .
- Resets daily and forcefully exits positions if left open overnight.

**Note:** In the forced exit logic, ensure that the `onOrder()` is called with the correct prices to mirror real-time exit. This keeps the execution log aligned for plotting.

**Robustness:** Failsafe conditions such as missing futures prices or incomplete data are handled with warnings and skipped execution.

## 4. PrintStats Module

**File:** printStats.py

- Reads output CSVs: pnl\_history.csv, execution\_log.csv.
- Computes:
  - Final P&L, Sharpe Ratio, Max Drawdown
  - Trade-level metrics like win rate and hold time
- Plots:
  - P&L Curve
  - Drawdown
  - Histogram of P&L Changes
  - Entry/Exit Markers on Futures Price

## 5. Sample Trades

Symbol	Side	Qty	Price
MARK:C-BTC-106500-240525	SELL	0.1	1303.44
MARK:P-BTC-106500-230525	SELL	0.1	1303.44
MARK:C-BTC-106500-240525	BUY	0.1	11.56
MARK:P-BTC-106500-230525	BUY	0.1	11.56

Table 1: Sample trades executed by the strategy

## 6. Performance Plots

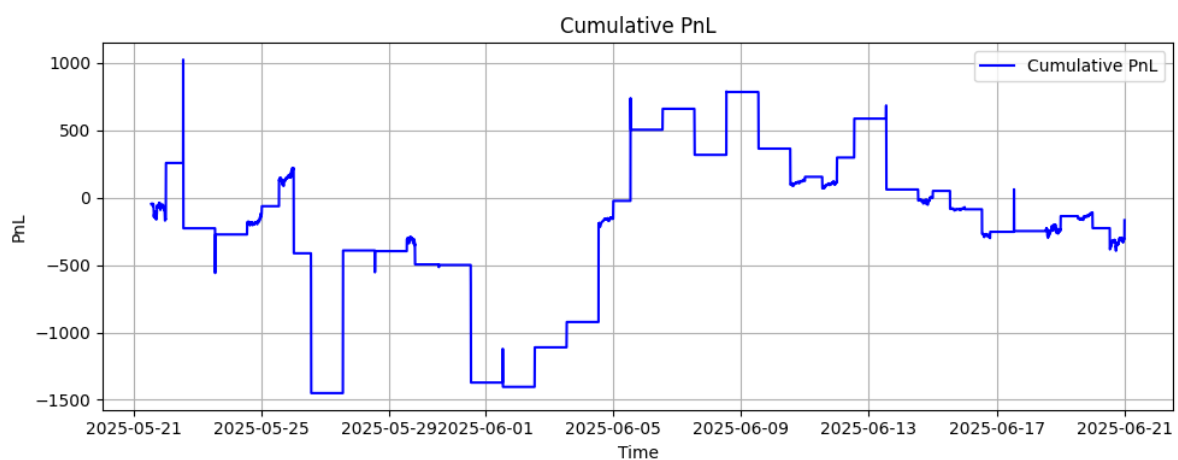


Figure 1: Cumulative P&L over time

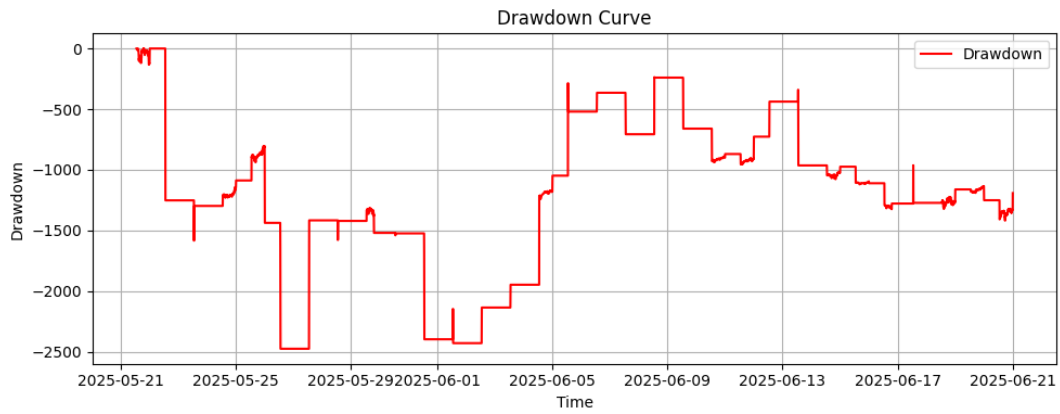


Figure 2: Drawdown curve

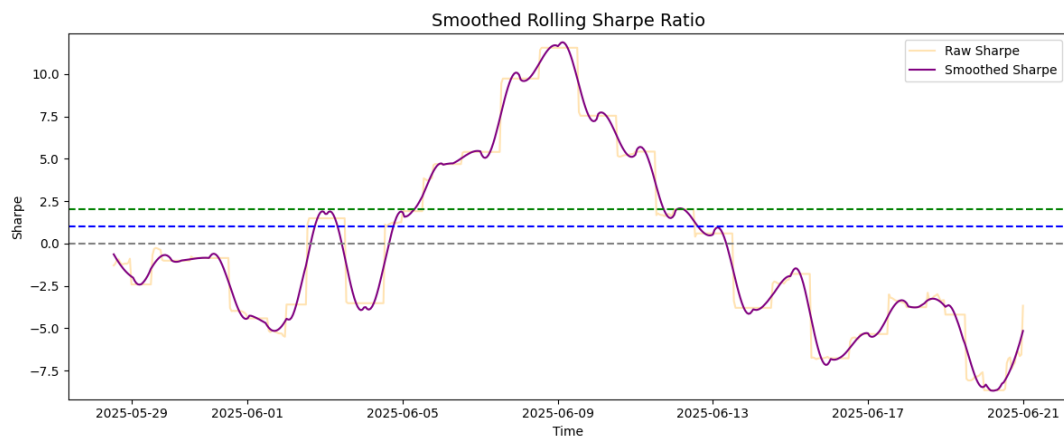


Figure 3: Rolling Sharpe ratio (5-min window)

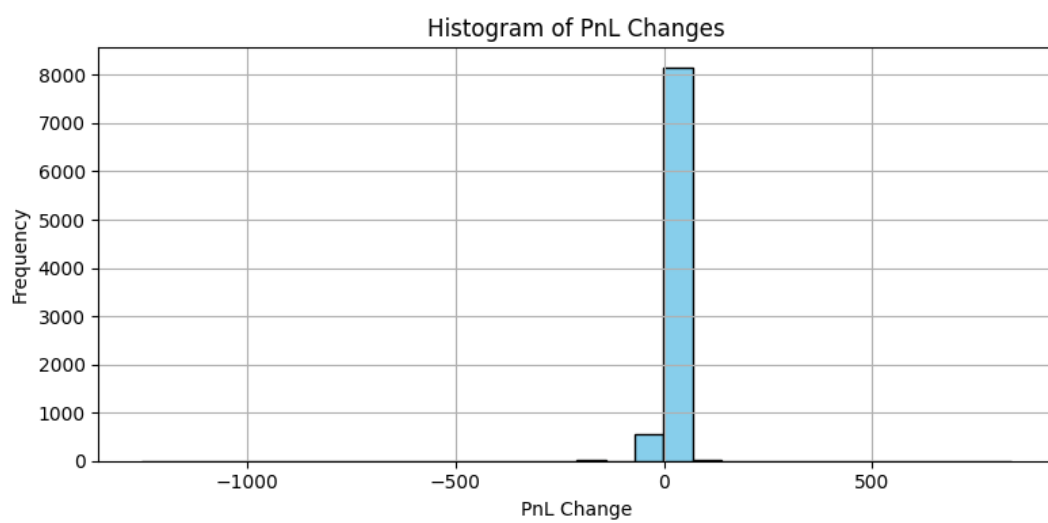


Figure 4: Entry/Exit points on futures price

## 7. Learnings and Improvements

- **What Worked:**

- Slippage modeling and clean-order execution abstraction.
- PnL and turnover tracking synced per tick.
- Forced exit logic avoided overnight positions.

- **What Didn't:**

- Simple exit condition (deviation  $> 1\%$ ) not adaptive to volatility.
- The strategy can be made more reactive with the management of Greeks or delta hedging.

- **Next Steps:**

- Add volatility-adjusted thresholds.
- Integrate real-time Greek computation.
- Support multiple entry legs (e.g., spreads or condors).