**Project Report: Options Data Analysis for AAPL**

**Introduction:**

This project is about Options Data Analysis for Apple Inc. (AAPL) using Python. Options are derivatives that give the buyer the right, but not the obligation, to buy (Call) or sell (Put) an underlying asset at a certain strike price before expiry.

The project involves fetching options data, cleaning it, calculating important metrics like Put/Call Ratio and Max Pain, and visualizing Implied Volatility to understand market sentiment and trader behavior.

**Step 1 – Data Collection**

Using the yfinance library, we downloaded:

* One year of historical stock prices for AAPL.
* List of available option expiration dates.

This gives both the historical performance of the stock and the available futures for options expiry analysis.

**Step 2 – Option Chain Selection**

From the list of option expiry dates, we selected the nearest expiry. For this expiry, we downloaded:

* Call options data
* Put options data

Option chain data contains important information such as strike prices, open interest, last traded price, and implied volatility.

**Step 3 – Data Cleaning**

Raw market data often contains missing or invalid values. We converted important columns like strike and open Interest to numeric types and filled missing values with zeros.

This ensures correct calculations and avoids errors during analysis.

**Step 4 – Put/Call Ratio (PCR) Calculation**

The Put/Call Ratio (PCR) is calculated as:



Interpretation:

* PCR > 1 → bearish sentiment (more puts than calls)
* PCR < 1 → bullish sentiment (more calls than puts)

This ratio gives a quick insight into whether the market is leaning bullish or bearish.

**Step 5 – Top Strike Prices Analysis**

We sorted both calls and puts by open interest and selected the Top 5 strike prices for each.

These strikes represent the price levels where traders have the most exposure. These are important because they act as support and resistance levels in the market.

**Step 6 – Max Pain Price Calculation**

The Max Pain Price is the strike price at which the total losses of option buyers (both calls and puts) are maximized.

We calculated this by summing losses for each strike price and finding the strike with minimum total loss for option sellers.

This is a widely used indicator because stock prices often tend to move towards the max pain level as expiry approaches.

**Step 7 – Implied Volatility Analysis**

We plotted Implied Volatility (IV) vs Strike Price.  
This plot usually shows a volatility smile or skew, indicating higher volatility for deep in-the-money and out-of-the-money options.

Implied Volatility reflects how expensive options are and how much risk the market expects in the future.

**Step 8 – Save Results**

We saved calls, puts, and max pain data into CSV files for reporting and sharing.

**Results Summary**

* **Put/Call Ratio** gave insight into market sentiment.
* **Top strike prices** showed where traders had maximum open interest.
* **Max pain price** gave an expected level for the stock price close to expiry.
* **IV plot** showed the volatility pattern across strike prices.

**Key Learnings**

From this project, I learned:

1. How to fetch real-world options and stock market data using Python (yfinance).
2. The importance of data cleaning to make financial data analysis accurate.
3. How to calculate the Put/Call Ratio and interpret market sentiment.
4. How to identify strike prices with maximum open interest to find important support and resistance levels.
5. How to compute Max Pain Price, an important indicator used by options traders to predict price movement near expiry.
6. How to visualize Implied Volatility and understand the concept of the volatility smile.
7. How options market data can be used to interpret trader psychology and market expectations.

**Final Insight:**  
This project showed that options data analysis is not just about pricing, but it is a way to read the “market sentiment” and understand how traders position themselves for future price moves. Techniques such as Put/Call Ratio, Max Pain, and IV analysis provide a deeper layer of market understanding beyond simple price charts.