Volatility Forecasting and Stock Selection using EGARCH

Step 1: Forecasting Period and Rolling Training

You are tasked with forecasting volatility for each stock in the Nifty 50 index.

- Use historical daily returns data from **1st June 2022 to 31st May 2024**.

- Implement a **rolling window of 90 trading days** to train your model and forecast 1-day-ahead volatility.

- This means:

  - Train your first model on data from **1st March 2022 to 31st May 2022**.
  - Forecast volatility for **1st June 2022**.
  - Then shift the window by one day and repeat this process until **31st May 2024**.

Step 2: Model Choice – EGARCH(1,1)

- Use the **EGARCH(1,1)** model to forecast volatility.

- Implement the model using appropriate Python libraries such as `arch`.

- In your report, clearly explain:

  - What EGARCH is
  - Why it is preferred over regular GARCH
  - The interpretation of each parameter in the EGARCH(1,1) formula

Step 3: Compute Expected Returns

- Compute daily log returns for each stock using data from **1st June 2022 to 31st May 2024**.

- Calculate the mean of these daily log returns to get the **expected return** for each stock:

$$E[R_i] = \frac{1}{T} \sum_{t=1}^{T} \log \left(\frac{P_t}{P_{t-1}} \right)$$

Step 4: Scoring the Stocks Based on Risk Aversion

- You are given a user-defined **risk aversion parameter** r such that $0 \leq r \leq 1$.

- Define the **score** for each stock i as:

$$\text{Score}_i = (1 - r) \cdot E[R_i] - r \cdot \sigma_i$$

where:

- $E[R_i]$ is the expected return of stock i
- σ_i is the **average of the forecasted volatilities** for that stock from Step 1
- r is the risk aversion coefficient:
    - $r \approx 0$: prioritize higher returns
    - $r \approx 1$: prioritize lower volatility

Step 5: Select Stocks Based on Score

- Rank all 50 stocks by their score in descending order.

- Select the top 2 stocks with the highest scores.

- These 2 stocks will be used in the backtesting phase.

Step 6: Backtesting Period and Strategy

- The backtesting period is from **1st June 2024 to 1st June 2025**.

- Allocate **equal capital** to the 2 selected stocks.

- Use any simple trading strategy of your choice (e.g., MACD, BB, Ichimoku Cloud).

- Enter a trade only when a clear buy signal is generated.

- Exit when the signal reverses or becomes neutral.

Step 7: Performance Evaluation

- Calculate the cumulative return of your 2-stock portfolio over the backtest period and call this R_{user}.

- Calculate the cumulative return of an equal-weighted Nifty 50 index over the same period and call this R_{market}.

- Define the **final user score** as:

$$\text{User Score} = \left(\frac{R_{\text{user}}}{R_{\text{market}}} \right) \times 100$$

- This score shows how well your personalized stock selection strategy performed compared to simply holding the market.