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Final Project Problem Statement - *Prophet*

Title: *Data-Driven Stock Analysis using Time Series Models on StockGro*

Objective
Participants will apply time series forecasting and analysis techniques to guide stock selection and capital allocation within a virtual ₹10,00,000 limit on the StockGro platform. The aim is to assess how predictive insights from models such as ARIMA, Prophet, and LSTM can enhance decision-making and manage short-term risk over a 2-day trading window.

Background
StockGro is a virtual stock market simulator that uses live NSE/BSE data, enabling users to trade, allocate funds, and monitor performance in real-time. This challenge encourages students to apply concepts from the Time Series Analysis course to real-market scenarios—demonstrating how data modeling can inform investment decisions in a practical, risk-free environment.

Data Requirements:

Participants must use historical stock price data imported using the `yfinance` Python library.
Example to fetch data:

In python-

```
import yfinance as yf

# Fetch last 60 days of daily stock data for Reliance

data = yf.download("RELIANCE.NS", period="60d", inte65erval="1d")
```

Dataset to be considered: 1st January, 2020 to 31st December, 2024.
Consider the **minimum of the last 6 months** of data during this period for **testing**.

Project Tasks:

1. Stock Universe Selection:

- Select a limited set of NSE-listed stocks (recommended: 5–10).
- Justify choices based on historical trends, volatility, or sector representation.
- Example methods:
    - Use rolling standard deviation to identify volatile stocks.
    - Apply seasonal decomposition to detect trending stocks.
    - Select stocks from diverse sectors for better coverage.

2. Data Preprocessing

- Ensure time series are ready for modeling by:
    - Handling **missing values** (e.g., forward/backward fill or removal).
    - Checking **stationarity** using **ADF test** and differencing if needed.
    - **Normalizing or scaling** data for ML-based models like LSTM.
    - Creating a **train-test split** (**minimum last 6 months** for validation).

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3. Time Series Forecasting

- Use one or more models such as:
    - **ARIMA / SARIMA**
    - **Exponential Smoothing (SES / Holt-Winters)**
    - **Facebook Prophet**
    - **LSTM / GRU**
    - **CNN**
    - **Any other pretrained model or transformer based models can be used**
- Forecast stock prices for the **next 2 trading days**.
- Tips:
    - Tune ARIMA using **AIC/BIC**, validate with residual analysis.

    - Compare model output with actual data using **MAPE**, **RMSE**, or **hit rate** (forecasted vs actual direction).

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4. Volatility & Trend Analysis

Use time series techniques to assess how stock prices are behaving and where they might be heading:

- **Estimate short-term volatility** using statistical models and historical price data:
    - Analyze fluctuations in log returns.
    - Use models that capture time-varying volatility to anticipate future uncertainty.
- **Identify underlying trends and patterns**:
    - Decompose stock price series into components like long-term trend, seasonality, and noise.
    - Evaluate the strength and consistency of the trend over time to guide decision-making.

These methods allow you to interpret price movements beyond the surface, using data-driven signals rooted in time series modeling.

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5. How to Select Stocks?

Choose **at least two** strategies from the following:

Forecast-Guided Allocation

- Use predictions from time series models to rank stocks by expected performance over a short horizon.
- Allocate more capital to stocks with stronger predicted gains and higher confidence in forecast accuracy.
- Consider adjusting weights based on the consistency or certainty of forecasts.

Volatility-Aware Sizing

Reduce overall risk by lessen the number of stocks to trade which are expected to show higher volatility.

- Use predicted volatility from GARCH(1,1) or rolling standard deviation of log returns.
- Weight each stock inversely proportional to its forecasted volatility:

$$w_i \propto \frac{1}{\hat{\sigma}_i} \qquad\qquad w_i = \frac{\frac{1}{\hat{\sigma}_i}}{\sum_{j=1}^{N} \frac{1}{\hat{\sigma}_j}}$$

- Normalize all weights to sum to 1.

Correlation-Based Diversification

- Select a mix of stocks that move independently to avoid concentrated risk.
- Use correlation analysis across recent time windows to identify combinations that provide better diversification.

Sector Momentum Rotation

- Group stocks by sector and assess how each sector is performing over time.
- Allocate more capital to sectors showing consistent upward movement.
- Within sectors, further refine allocations using any of the above strategies.

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6. Model Comparison

- Compare forecasting models used in Task 3:
    - Evaluate using **MAPE**, **RMSE**, or **directional accuracy**.
    - Comment on strengths and weaknesses of each model.
- Consider **ensemble predictions** for better accuracy.
- Optionally combine model predictions for greater robustness.

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7. StockGro Virtual Execution

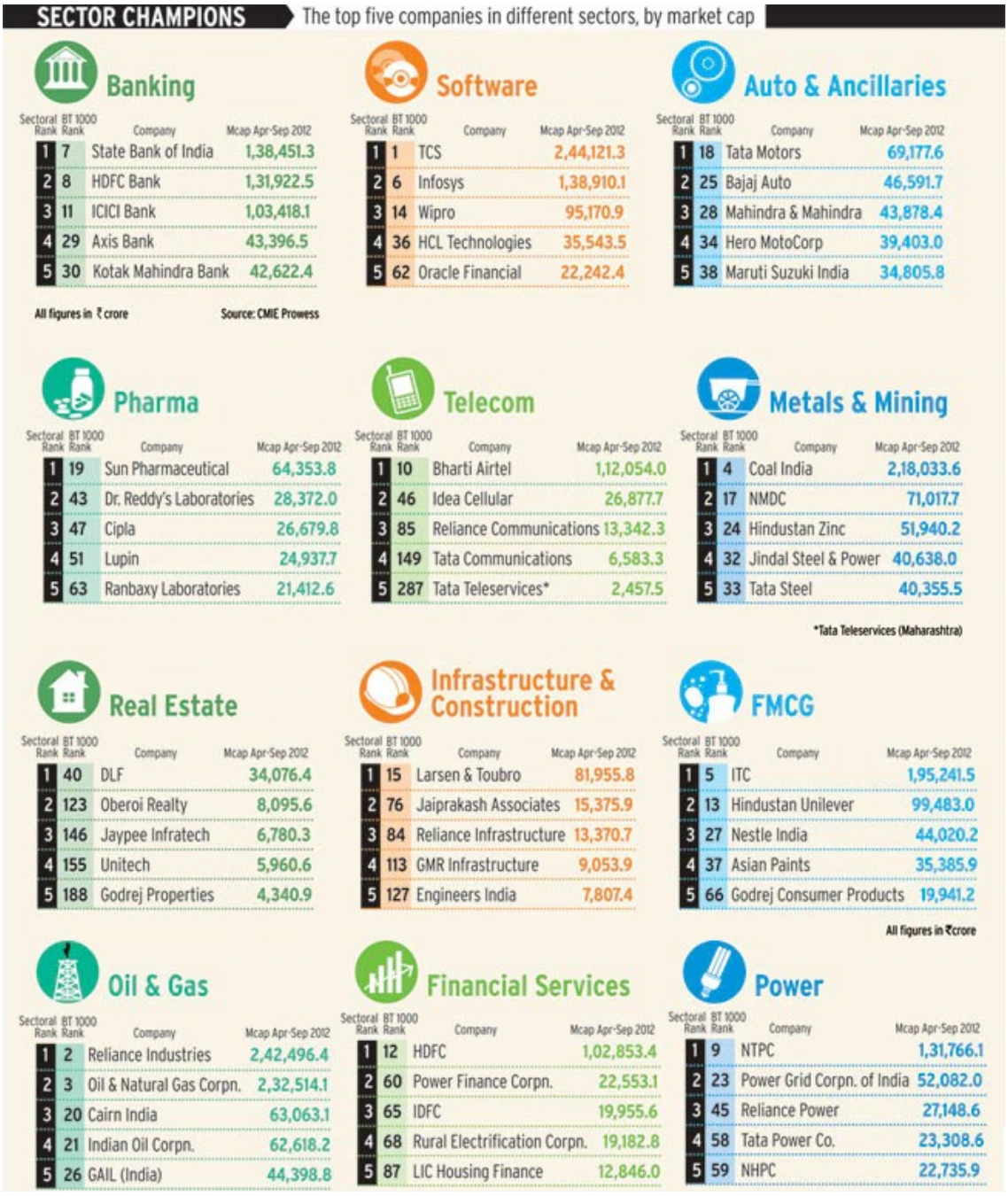
Register and Join the Prophet League on StockGro To ensure you are enrolled in the trading league, follow these steps:

- Register here to gain access: https://community.stockgro.club/form/2935407a-2aa5-4e3a-90fc-afd8036b5cd1

- Login to the StockGro mobile app or web platform.
- After 5 minutes, go to the Upcoming Leagues section and locate "Prophet".
- Enroll in the league before it begins.
  Note: Once the league starts, no new entries will be allowed.
- Trading Window:
  - Start: 9:35 AM, 12 May 2025
  - End: 3:25 PM, 13 May 2025
- To confirm enrollment, check the ‘My Prep Zone’ in the app.
  If “Prophet” appears there, your registration is successful.
- Need help? Watch the tutorial video:
  https://www.youtube.com/watch?v=70MWjoptEgY

After logging into the **StockGro App:**

- Deploy your strategy with ₹10,00,000.
- Execute trades **before Day 1 market close**.
- Track and report performance on **Day 2 market close** using in-app portfolio metrics.



This is just a list of common stocks in these sectors, here as an example for your reference, **feel free to choose any stocks of your choice**.

Final Submission Must Include:

- Ipynb notebook/python files for evaluation purposes including data analysis and prediction.

A **sample notebook** for your reference is provided:
stock_price_prediction_using_yfinance[1].ipynb

- A concise **report** (max 6 pages) covering:
    - Methodology and models used
    - Stock selection rationale
    - Forecast results and confidence intervals
    - Portfolio composition and rationale
    - Performance on StockGro (returns, volatility, key trades)
    - Model accuracy and prediction vs reality
    - Reflections: What worked, what didn't, what you'd improve
- (Optional Bonus): Visual dashboard or interactive plot of:
    - Forecast Plots: Actual vs predicted stock prices.
    - Portfolio Allocation Charts: Pie/bar plots showing allocation by stock/sector.
    - Correlation Heatmaps: If using diversification strategy.
    - Trend & Volatility Graphs: To support strategy rationale.

Submission link:
https://forms.office.com/Pages/ResponsePage.aspx?id=jacKheGUxkuc84wRtTBwHMCiEbpZN_tGsGuqOmiYCptUQ1dZTFg1VVk4RkJNOFkyQldEU0NLSFFJWC4u&embed=true