##### MYSQL simple - All approach with explanation

1. DataSet
2. Questions
   1. Pick an industry (tech, auto, etc)
   2. Compare stocks (eg. how a stock behaves across different countries)
   3. Prediction algorithm using Regression
   4. Signatures best for learning algorithm
   5. Pick companies and check trends
3. Homework for 10/20
   1. Make GitHub (Kriti)
   2. Learn what a stock is; what finance/stock people are interested in.
   3. How do stocks work? Are they connected between different countries? Are they the same? Are they independent?
   4. Find one more dataset. Use Yahoo Finance.
   5. (Optional) Think of a question you are interested in/passionate about.
   6. (Optional) Research what methods are typically employed.
   7. (Optional) Research the issues with finance datasets (volatility, etc.)
4. Final Research Questions
   1. Regression based prediction of market indices (like S&P 500, NASDAQ, DOW)
   2. Create a new industry-specific index?
5. To Do as of Oct 25
   1. EDA (Focus on the time series) on S&P Data (https://www.nasdaq.com/market-activity/index/spx/historical?page=1&rows\_per\_page=100&timeline=y10)
   2. Hitesh:
6. Meeting on Nov 6 (Goals for this week):
   1. Current methods: meh. Look for other methods (eg tree based models, etc). Look for examples on Kaggle
   2. (Limin, can you please put some links here for us)

1. A notebook for time series analysis

<https://www.kaggle.com/code/thebrownviking20/everything-you-can-do-with-a-time-series/notebook>

2 S&P 500 || Time Series Forecasting with Prophet

<https://www.kaggle.com/code/janiobachmann/s-p-500-time-series-forecasting-with-prophet/notebook#Time-Series-Forecast-with-Prophet>

Prophet is an open-source forecasting tool developed by Facebook's Core Data Science team. It is designed for time series forecasting.

* 1. Do we use our methods only on the “Closing” variable or use the other “features”. Do we even have features? (Get a better understanding of these methods)
  2. Look for methods that predict “the trend” (0 or 1).

**Proposal for Modeling Approach at the Erdos Institute – Stock prices**

Introduction: We are excited to present a comprehensive modeling approach aimed at predicting stock prices, leveraging various time-series forecasting techniques. Our team has utilized sophisticated models such as ARIMA, double exponential smoothing, and ensemble methods to enhance the accuracy and reliability of stock price predictions.

**Key Predictors and Outcomes:**

1. Predictors:
   * Historical stock prices (Opening, Closing, High, Low)
   * Time series features
   * Economic indicators and external factors
2. Outcomes:
   * Closing prices for future time points
   * Price differentials (Closing - Opening)

**Modeling Techniques:**

1. ARIMA (AutoRegressive Integrated Moving Average):
   * ARIMA is a powerful time-series forecasting model that captures the temporal dependencies in stock price data.
   * It considers the auto-regressive, integrated, and moving average components to make predictions.
2. Double Exponential Smoothing:
   * Double Exponential Smoothing, or Holt's method, is utilized to capture trends and seasonality in stock prices.
   * The method incorporates both level and trend smoothing to enhance the accuracy of predictions.
3. Ensemble Methods:
   * We have employed ensemble methods, combining the predictions from multiple models to mitigate individual model weaknesses.
   * Boosting and bagging techniques are implemented to create a robust ensemble that can adapt to different market conditions.

**Methodological Approach:**

1. Data Preprocessing:
   * Historical stock price data is cleaned and preprocessed to handle missing values and outliers.
   * Feature engineering is performed to extract relevant information from the time series.
2. Model Training:
   * The ARIMA model is trained on historical data to capture the underlying patterns and temporal dependencies.
   * Double Exponential Smoothing is optimized for smoothing parameters to enhance its forecasting capabilities.
   * Ensemble models are constructed using boosting and bagging to combine the strengths of multiple forecasting techniques.
3. Validation and Evaluation:
   * The models are rigorously validated using time-series cross-validation techniques to ensure robust performance.
   * Evaluation metrics such as root mean square error (RMSE) are employed to quantify the accuracy of predictions.

**Expected Impact:** The proposed modeling approach aims to provide accurate and reliable predictions of stock prices, aiding investors and financial analysts in making informed decisions. By combining the strengths of various modeling techniques, our approach seeks to enhance forecasting accuracy and contribute to the understanding of market dynamics.

We look forward to the opportunity to collaborate with the Erdos Institute, leveraging our expertise in time-series forecasting and predictive modeling to contribute valuable insights to the financial domain.

Thank you for considering our proposal.

Sincerely,

Guestimate Gang

**Michail’s personal statement:**

**Project Overview:** In this project I applied a variety of forecasting methods, including [average, naïve, trend, random wank with a drift, ARIMA, double exponential smoothing, ensemble methods], to analyze historical stock data. The project's primary objectives were to predict future stock prices.

**Methods Applied:**

**ARIMA Modeling:** I utilized ARIMA models to capture the temporal dependencies in the stock price data.

**Double Exponential Smoothing:** Double Exponential Smoothing, also known as Holt's method, was employed to capture trend in the data. This method contributed to a more robust understanding of the underlying patterns.

**Ensemble Methods:** Leveraging ensemble methods, such as Gradient Boosting, allowed me to create a more accurate and robust predictive model.

**Challenges Faced:** During the course of the project, I encountered challenges such as understanding the predictions using the aforementioned methods. Also optimising the hyperparameters was struggling. Overcoming these challenges enhanced my problem-solving skills and deepened my understanding of how these work.

**Limin’s personal statement**

To predict the closing price of SP500 index, I take the following steps:

1 **Data Collection**

<https://www.nasdaq.com/market-activity/index/spx/historical?page=254&rows_per_page=10&timeline=y10>

2 **Data Preprocessing**

* Clean the data by handling missing values on holidays because there is no trading on these days.
* Convert date to a time stamp, time series format
* Rename the column name for convenience

3 **Explorary Data Analysis(EDA)**

Plot time series to identify the underlying pattern in the data, such as trend, sensonality or noise

4 **Splitting the Data**

Split the data into train and test set.

5 **Baseline Models**

Calculate the average cross-validation root mean squared error for the 4 baseline models average, naive, tend and random walk with drift.

6 **Model Selections**

Moving average, exponential smoothing, Arima,Ensembel model such as XGBoost

7 **Model Training**

Train the selected model on the training data. Tune hyperparameters to optimize the model's performance

8 **Model validation**

Evaluate the model's performance on the testing data using RMSE

Questions:

1 Do we need to do data splitting before the data preprocessing for time series forecasting?

2 How do we deal with the data on holidays?

Kriti:

1. EDA:

**What is a Stock**: A stock, also known as a share or equity, represents ownership in a corporation. When you buy a stock, you are purchasing a piece of that company. The total ownership of the company is divided into shares, and owning shares of a company's stock makes you a shareholder. Shareholders have a claim on the company's assets and earnings proportional to the number of shares they own. Stocks are one of the most common and accessible types of investments.

**What Finance/Stock People are Interested in**: People involved in finance and the stock market are often interested in various aspects, including:

* **Valuation**: Analysing the fundamental and technical factors to determine the fair value of a stock.
* **Trading**: Buying and selling stocks with the goal of making a profit. Traders use various strategies, including day trading, swing trading, and long-term investing.
* **Investing**: Long-term investors buy stocks with the intention of holding them for an extended period to benefit from capital appreciation and dividends.
* **Risk Management**: Assessing and managing risks associated with stock investments.
* Financial Analysis: Analysing a company's financial statements, earnings reports, and economic conditions to make investment decisions.
* **Market Analysis**: Monitoring market trends, economic indicators, and geopolitical events that can influence stock prices.
* Portfolio Management: Building and managing diversified portfolios to achieve investment goals while minimising risk.

**How Stocks Work**: Stocks are bought and sold on stock exchanges, which are organized and regulated marketplaces where buyers and sellers can trade shares. When you buy a stock, you're essentially purchasing a share of ownership in a company. As a shareholder, you have the potential to make money in two ways:

* **Capital Gain**: You can make a profit by selling your shares for a higher price than what you paid for them. If the stock's value increases, you benefit from the capital gain.
* **Dividends**: Some companies pay dividends to their shareholders, which are a portion of the company's profits distributed to the owners. Dividends provide a source of income to shareholders.

**Stocks Across Different Countries**: Stock markets are not the same across different countries. Each country typically has its own stock exchange(s) and regulatory framework. However, they are not entirely independent either, and there is a significant level of interconnection between global stock markets due to globalisation and international investments.

Factors that connect stock markets between different countries include:

* **Global Investors**: Institutional and individual investors often diversify their portfolios by investing in stocks from various countries.
* **Global Events**: Global economic events, political developments, and major news can impact stock markets worldwide.
* **Foreign Investment**: Companies listed on one country's stock exchange may attract foreign investors.
* **Global Funds**: There are mutual funds and exchange-traded funds (ETFs) that invest in stocks from different countries, providing investors with global exposure.

While there are connections and interdependencies, each stock market is influenced by its own set of local factors, regulations, and economic conditions. Investors should consider both local and global factors when making investment decisions involving international stocks.

**Can Google be in stockmarket of India and in stock market of US? If yes, what does it mean ?**

Yes, Google, or its parent company Alphabet Inc., can be listed on both the stock markets in India and the stock markets in the United States. This is possible because many large, multinational corporations have shares listed on multiple stock exchanges around the world. When a company is listed on multiple stock exchanges, it's often referred to as having a dual listing or being cross-listed.

Here's what it means when a company like Google is listed on both the Indian and U.S. stock markets:

* **Global Access to Investors**: By listing on multiple stock exchanges, a company can access a larger pool of investors from different parts of the world. This can increase the liquidity of the company's shares and potentially attract more investment.
* **Local and International Trading**: Investors in both India and the United States can buy and sell shares of the company's stock on their respective exchanges in their local currency. This allows for more convenient and familiar trading for local investors.
* **Visibility and Prestige**: Being listed on multiple stock exchanges can enhance a company's visibility and prestige. It can signal that the company is a global player with a presence in multiple markets.
* **Compliance with Local Regulations**: Companies that list their shares on foreign stock exchanges need to comply with the regulations and reporting requirements of those exchanges. This can include providing financial information in accordance with the accounting standards of the foreign country.
* **Currency Exchange**: When a company's shares are listed on multiple exchanges in different countries, investors need to consider currency exchange rates when buying and selling those shares. Changes in currency exchange rates can impact the returns on investment.

It's important to note that not all companies are eligible or choose to list on multiple stock exchanges. The decision to cross-list depends on the company's global business strategy, regulatory requirements, and the benefits it seeks to gain from the additional listings.

In the case of Google (Alphabet Inc.), its shares are primarily listed on the NASDAQ stock exchange in the United States, but it is available for trading to investors around the world. While it may not be directly listed on Indian stock exchanges, Indian investors can still access Google's shares through various means, such as ADRs (American Depositary Receipts) or through investment in global funds that hold shares of the company.

**When the stock prices of a company (that appears in many countries) drop, say in India, would they drop the same in the US?**

The stock prices of a company that appears in multiple countries, such as a multinational corporation, may not necessarily drop in the same way or at the same time in all the countries where it is listed. Several factors can contribute to variations in how stock prices react in different markets:

* **Global vs. Local Factors**: Stock prices are influenced by a combination of global and local factors. While some factors, like major global economic events or the overall performance of the company, can affect stock prices uniformly across different markets, other factors, such as local economic conditions, regulations, and investor sentiment, can vary significantly.
* **Time Zones**: Stock markets in different countries operate in different time zones, so news and events occurring outside of each market's operating hours may impact prices when the market opens. This can lead to variations in price movements.
* **Currency Exchange Rates**: Exchange rate fluctuations can affect how investors perceive the value of a stock when it is traded on different stock exchanges in different currencies. Currency exchange rates can be influenced by global events and market sentiment.
* **Regulatory Differences**: Each country has its own regulatory framework, reporting requirements, and investor protections. Companies may have different obligations and standards when listing on different stock exchanges. Changes in regulatory conditions can impact stock prices.
* **Market Liquidity**: The level of liquidity and trading activity in a particular market can also influence stock price movements. Smaller markets may experience more significant price swings due to lower trading volumes.
* **Investor Sentiment**: Local investor sentiment can play a substantial role in stock price movements. Different regions may have varying investor perceptions, risk appetites, and reactions to news and events.
* **Company-Specific Factors**: The way a company operates in different regions can also impact its stock price. Company-specific news, performance, and strategy can differ across markets.

While there are commonalities in how global events can affect stock prices, it's important to recognize that stock markets in different countries are semi-independent, and variations in stock price movements are normal. This is why you might observe differences in how the stock price of a multinational company, like a large tech corporation, reacts in India compared to the United States or other countries. Investors and traders often monitor these differences to take advantage of potential arbitrage opportunities or diversify their investments across different markets.

* Correlations of DOW, S&P 500, Nasdaq;
* In which companies to invest for higher return?