Laboratory Activities for Week 12:
Time Series Analysis and Forecasting

SC310005 Artificial Intelligence
Khon Kaen Business School

https://github.com/kaopanboonyuen/SC310005_ArtificialIntelligence_2023s1

(10 Points) Stock Price Prediction Using Time Series Models

Motivation:
Understanding time series analysis and forecasting is crucial for financial analysis and investment decision-making. By analyzing historical stock data and applying time series models, students can gain insights into stock price trends and volatility, which are essential for making informed investment decisions.
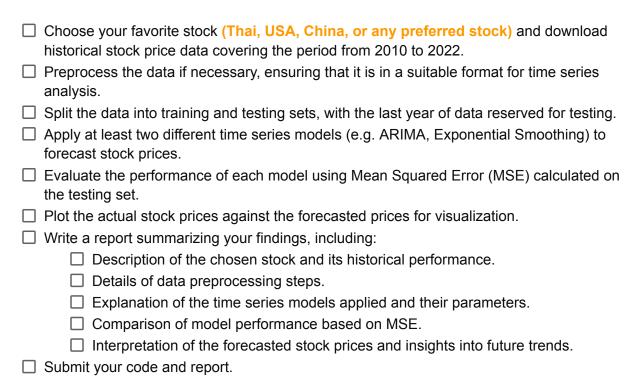
Assignment Objectives:
- Gain practical experience in collecting and preprocessing financial time series data.
- Understand the concepts of time series modeling and forecasting.
- Learn how to split time series data into training and testing sets for model evaluation.
- Apply various time series models to forecast stock prices.
- Evaluate model performance using metrics such as Mean Squared Error (MSE).
- Visualize the forecasted stock prices and compare them with actual values.

Objective:

The objective of this assignment is to download historical stock price data for a selected stock (Thai, USA, China, or any preferred stock) covering the period from 2010 to 2022. Students will split the data into training and testing sets, with the last year of data reserved for testing. They will then apply time series models, such as ARIMA, SARIMA, or Exponential Smoothing, to forecast stock prices. Finally, students will evaluate the models based on MSE and visualize the forecasted stock prices.

Task for Students:

- ☐ Choose your favorite stock **(Thai, USA, China, or any preferred stock)** and download historical stock price data covering the period from 2010 to 2022.
- ☐ Preprocess the data if necessary, ensuring that it is in a suitable format for time series analysis.
- ☐ Split the data into training and testing sets, with the last year of data reserved for testing.
- ☐ Apply at least two different time series models (e.g. ARIMA, Exponential Smoothing) to forecast stock prices.
- ☐ Evaluate the performance of each model using Mean Squared Error (MSE) calculated on the testing set.
- ☐ Plot the actual stock prices against the forecasted prices for visualization.
- ☐ Write a report summarizing your findings, including:
    - ☐ Description of the chosen stock and its historical performance.
    - ☐ Details of data preprocessing steps.
    - ☐ Explanation of the time series models applied and their parameters.
    - ☐ Comparison of model performance based on MSE.
    - ☐ Interpretation of the forecasted stock prices and insights into future trends.
- ☐ Submit your code and report.

10 well-known stocks from various industries and regions:

1. **Apple Inc. (AAPL)**: An American multinational technology company known for its consumer electronics, software, and online services.

2. **Amazon.com Inc. (AMZN)**: An American multinational technology company that focuses on e-commerce, cloud computing, digital streaming, and artificial intelligence.

3. **Alphabet Inc. (GOOGL)**: The parent company of Google, which specializes in Internet-related services and products, including search engines, online advertising technologies, cloud computing, software, and hardware.

4. **Microsoft Corporation (MSFT)**: An American multinational technology company known for its software products, including the Windows operating systems, Office suite, and Azure cloud services.

5. **Tesla, Inc. (TSLA)**: An American electric vehicle and clean energy company known for its electric cars, solar energy products, and energy storage solutions.

6. **Facebook, Inc. (FB)**: An American social media and technology company known for its social networking platform Facebook, as well as Instagram, WhatsApp, and Oculus VR.

7. **Johnson & Johnson (JNJ)**: An American multinational corporation known for its pharmaceutical, medical devices, and consumer goods.

8. **JPMorgan Chase & Co. (JPM)**: An American multinational investment bank and financial services holding company known for its banking, asset management, and financial services.

9. **Walmart Inc. (WMT)**: An American multinational retail corporation known for its chain of hypermarkets, discount department stores, and grocery stores.

10. **Berkshire Hathaway Inc. (BRK.B)**: An American multinational conglomerate holding company known for its diverse range of businesses, including insurance, railroads, utilities, manufacturing, services, and retailing.

10 well-known stocks from Thailand:

1. **Advanced Info Service Public Company Limited (ADVANC.BK)**: A leading telecommunications company in Thailand providing mobile phone and internet services.

2. **PTT Public Company Limited (PTT.BK)**: Thailand's state-owned oil and gas company engaged in the exploration, refining, distribution, and marketing of petroleum products.

3. **CP All Public Company Limited (CPALL.BK)**: A retail and convenience store operator in Thailand, operating under the 7-Eleven brand.

4. **Siam Cement Public Company Limited (SCC.BK)**: A leading building materials and construction company in Thailand, involved in cement manufacturing, petrochemicals, and packaging.

5. **Kasikornbank Public Company Limited (KBANK.BK)**: One of the largest banks in Thailand, offering a wide range of financial services including retail banking, corporate banking, and investment banking.

6. **Bangkok Bank Public Company Limited (BBL.BK)**: One of the oldest and largest banks in Thailand, providing banking and financial services to individuals and businesses.

7. **Siam Commercial Bank Public Company Limited (SCB.BK)**: Another major commercial bank in Thailand, offering banking services, investment banking, and asset management.

8. **PTT Exploration and Production Public Company Limited (PTTEP.BK)**: A subsidiary of PTT Group, PTTEP is Thailand's largest oil and gas exploration and production company.

9. **Central Group (CENTEL.BK)**: A diversified conglomerate in Thailand involved in retail, real estate development, hotels, and restaurants.

10. **TMB Bank Public Company Limited (TMB.BK)**: A commercial bank in Thailand offering retail banking, corporate banking, and financial services.