University of Information Technology & Sciences

Department of Computer Science and Engineering

Project Report

Course Title: Simulation and Modeling Lab

Course Code: CSE 413

Project Title : STOCK RETURN ANALYSIS USING KOLMOGOROV SMIRNOV TEST

Submitted To

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1.Objective

- To analyze the daily return behavior of Apple Inc. (AAPL) stock for the year 2023.
- To apply the Kolmogorov–Smirnov (K–S) Test and determine whether the returns follow a normal distribution.
- To understand the statistical properties of stock returns and assess the applicability of financial models.

2. Tools

- **Google Colab** – cloud-based coding platform
- **Python** – programming language
- **Libraries Used**:
  - pandas – for data processing
  - matplotlib – for visualization
  - scipy.stats – for the K–S Test
- **Data Source**: Yahoo Finance

3. Methodology

1. Downloaded historical AAPL stock data (2023) in CSV format.
2. Loaded the dataset into Google Colab using pandas.
3. Calculated daily returns using percentage change in adjusted close prices.
4. Performed Kolmogorov–Smirnov test to compare with normal distribution.
5. Plotted histogram of returns for visual inspection.
6. Analyzed p-value and K–S statistic for interpretation.

Program :

```
[ ]  import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
     from scipy.stats import kstest, norm

     # Load CSV file
     df = pd.read_csv("SML.csv")

     # Convert 'Date' to datetime format and set as index
     df['Date'] = pd.to_datetime(df['Date'])
     df.set_index('Date', inplace=True)

     # Show the first 5 rows
     df.head()
```

```
[ ]  # Strip spaces from column names just in case
     df.columns = df.columns.str.strip()

     # Choose the best available column for price
     price_col = 'Close'

     # Calculate returns
     returns = df[price_col].pct_change().dropna()
```

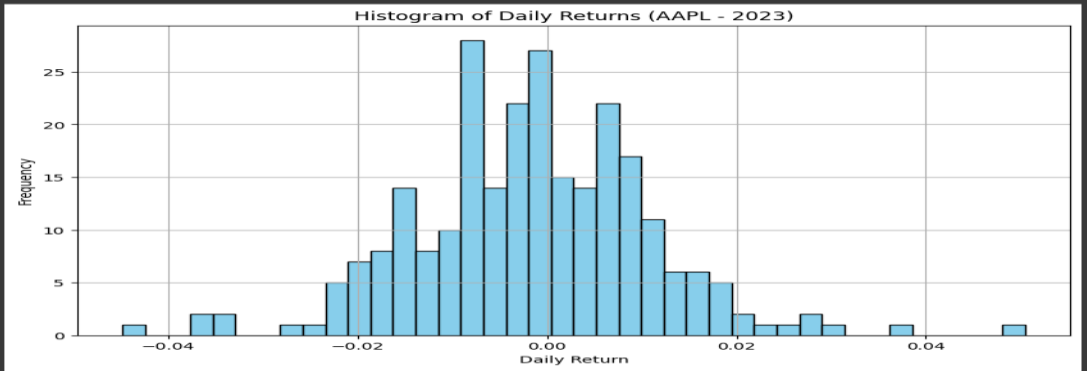
```
[ ]  # Mean and std of returns
     mean = returns.mean()
     std = returns.std()

     # Perform K-S test
     ks_stat, p_value = kstest(returns, 'norm', args=(mean, std))

     print(f"Kolmogorov-Smirnov Statistic: {ks_stat:.4f}")
     print(f"P-Value: {p_value:.4f}")

     # Interpretation
     if p_value < 0.05:
         print("Conclusion: Returns do NOT follow a normal distribution (reject H0).")
     else:
         print("Conclusion: Returns may follow a normal distribution (fail to reject H0).")
```

```
Kolmogorov-Smirnov Statistic: 0.0451
P-Value: 0.6598
Conclusion: Returns may follow a normal distribution (fail to reject H0).
```

4. Result / Outcome

- **K–S Statistic**: 0.0454
- **P-Value**: 0.6529
- **Interpretation**: Since p-value > 0.05, the null hypothesis is not rejected. The returns **may follow a normal distribution**, making standard financial models applicable.

```
[ ]  # Plot histogram
     plt.figure(figsize=(10, 6))
     plt.hist(returns, bins=40, color='skyblue', edgecolor='black')
     plt.title("Histogram of Daily Returns (AAPL - 2023)")
     plt.xlabel("Daily Return")
     plt.ylabel("Frequency")
     plt.grid(True)
     plt.show()
```



5. Conclusion

- The daily stock returns of Apple Inc. for 2023 **do not significantly deviate** from a normal distribution.
- The K–S test confirms the validity of using normal distribution assumptions in financial analysis for this dataset.
- This method can be extended to other stocks or years for further validation.

6. Reference

- Yahoo Finance: https://finance.yahoo.com
- SciPy Documentation: https://docs.scipy.org
- matplotlib & pandas documentation
- Google Colab

7. Github Link :

https://github.com/BadshaKhan137/STOCK-RETURN-ANALYSIS-USING-KOLMOGOROV-SMIRNOV-TEST.git