Problem Statement and Project Overview

- For investors to properly manage their portfolios, they need to visualize datasets, find useful patterns, and gain valuable insights such as stock daily returns and risks.
- In this project, we will use the power of python to perform stock data visualization and stock return calculation.

```
# Mount the drive
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from copy import copy
from scipy import stats
import plotly.express as px
import plotly.figure_factory as ff
import plotly.graph_objects as go
```

```
# Read the stock data csv file
# use Pandas to read the file
stock_df = pd.read_csv('/content/drive/MyDrive/PYTHON SEMUA/MASTER PYTHON for FINANCE (udemy 2 dec 2024)/Colab Notebooks/UDEMY Python for Fi
```

```
# AAPL = Apple
# BA = Boeing
# T = AT&T
# MGM = MGM Resort International (Hotel Industry)
# IBM = IBM
# TSLA = Tesla Motors
# GOOG = Google
# sp500 = US Stock Market
```

```
stock_df
```

	Date	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
0	2012-01-12	60.198570	75.510002	30.120001	12.130000	175.929993	180.550003	28.250000	313.644379	1295.500000
1	2012-01-13	59.972858	74.599998	30.070000	12.350000	178.419998	179.160004	22.790001	311.328064	1289.089966
2	2012-01-17	60.671429	75.239998	30.250000	12.250000	181.660004	180.000000	26.600000	313.116364	1293.670044
3	2012-01-18	61.301430	75.059998	30.330000	12.730000	189.440002	181.070007	26.809999	315.273285	1308.040039
4	2012-01-19	61.107143	75.559998	30.420000	12.800000	194.449997	180.520004	26.760000	318.590851	1314.500000
...	...	...	...	...	...	...	...	...	...	...
2154	2020-08-05	440.250000	174.279999	29.850000	16.719999	3205.030029	125.449997	1485.020020	1473.609985	3327.770020
2155	2020-08-06	455.609985	172.199997	29.840000	18.459999	3225.000000	126.120003	1489.579956	1500.099976	3349.159912
2156	2020-08-07	444.450012	170.020004	30.020000	19.030001	3167.459961	124.959999	1452.709961	1494.489990	3351.280029
2157	2020-08-10	450.910004	179.410004	30.200001	21.650000	3148.159912	127.110001	1418.569946	1496.099976	3360.469971
2158	2020-08-11	437.500000	180.130005	30.200001	21.500000	3080.669922	126.750000	1374.390015	1480.319946	3333.689941

2159 rows × 10 columns

```
# Sort the stock data by date
stock_df = stock_df.sort_values('Date')
stock_df
```

	Date	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
0	2012-01-12	60.198570	75.510002	30.120001	12.130000	175.929993	180.550003	28.250000	313.644379	1295.500000
1	2012-01-13	59.972858	74.599998	30.070000	12.350000	178.419998	179.160004	22.790001	311.328064	1289.089966
2	2012-01-17	60.671429	75.239998	30.250000	12.250000	181.660004	180.000000	26.600000	313.116364	1293.670044
3	2012-01-18	61.301430	75.059998	30.330000	12.730000	189.440002	181.070007	26.809999	315.273285	1308.040039
4	2012-01-19	61.107143	75.559998	30.420000	12.800000	194.449997	180.520004	26.760000	318.590851	1314.500000
...	...	...	...	...	...	...	...	...	...	...
2154	2020-08-05	440.250000	174.279999	29.850000	16.719999	3205.030029	125.449997	1485.020020	1473.609985	3327.770020
2155	2020-08-06	455.609985	172.199997	29.840000	18.459999	3225.000000	126.120003	1489.579956	1500.099976	3349.159912
2156	2020-08-07	444.450012	170.020004	30.020000	19.030001	3167.459961	124.959999	1452.709961	1494.489990	3351.280029
2157	2020-08-10	450.910004	179.410004	30.200001	21.650000	3148.159912	127.110001	1418.569946	1496.099976	3360.469971
2158	2020-08-11	437.500000	180.130005	30.200001	21.500000	3080.669922	126.750000	1374.390015	1480.319946	3333.689941

2159 rows × 10 columns

```
stock_df.columns[1:]
```

```
Index(['AAPL', 'BA', 'T', 'MGM', 'AMZN', 'IBM', 'TSLA', 'GOOG', 'sp500'], dtype='object')
```

```
# Print out the number of stocks
print('Total Number of stocks :{}'.format(len(stock_df.columns[1:])))
```

```
Total Number of stocks :9
```

```
# Average return of stock
stock_df[stock_df.columns[1:]].mean()
```

	0
AAPL	140.819823
BA	189.942700
T	35.162899
MGM	23.105743
AMZN	915.665665
IBM	161.853001
TSLA	259.600815
GOOG	783.712512
sp500	2218.749554

dtype: float64

```
# standard deviation
stock_df[stock_df.columns[1:]].std()
```

	0
AAPL	70.827601
BA	103.678586
T	3.207490
MGM	6.963847
AMZN	697.838905
IBM	25.561938
TSLA	210.988003
GOOG	334.448057
sp500	537.321727

dtype: float64

```
# All stocks description
stock_df.describe()
```

	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
count	2159.000000	2159.000000	2159.000000	2159.000000	2159.000000	2159.000000	2159.000000	2159.000000	2159.000000
mean	140.819823	189.942700	35.162899	23.105743	915.665665	161.853001	259.600815	783.712512	2218.749554
std	70.827601	103.678586	3.207490	6.963847	697.838905	25.561938	210.988003	334.448057	537.321727
min	55.790001	67.239998	26.770000	7.140000	175.929993	94.769997	22.790001	278.481171	1278.040039
25%	89.165714	124.015000	33.040001	18.545000	316.490005	142.769997	184.595001	527.214416	1847.984985
50%	116.599998	142.419998	34.930000	23.780001	676.010010	156.949997	231.960007	737.599976	2106.629883
75%	175.019997	297.044998	37.419998	28.430000	1593.645019	185.974998	307.350006	1079.744995	2705.810059
max	455.609985	440.619995	43.470001	38.029999	3225.000000	215.800003	1643.000000	1568.489990	3386.149902

Exploratory Data Analysis

```
# Check if data contains any null values
stock_df.isnull().sum()
```

	0
Date	0
AAPL	0
BA	0
T	0
MGM	0
AMZN	0
IBM	0
TSLA	0
GOOG	0
sp500	0

dtype: int64

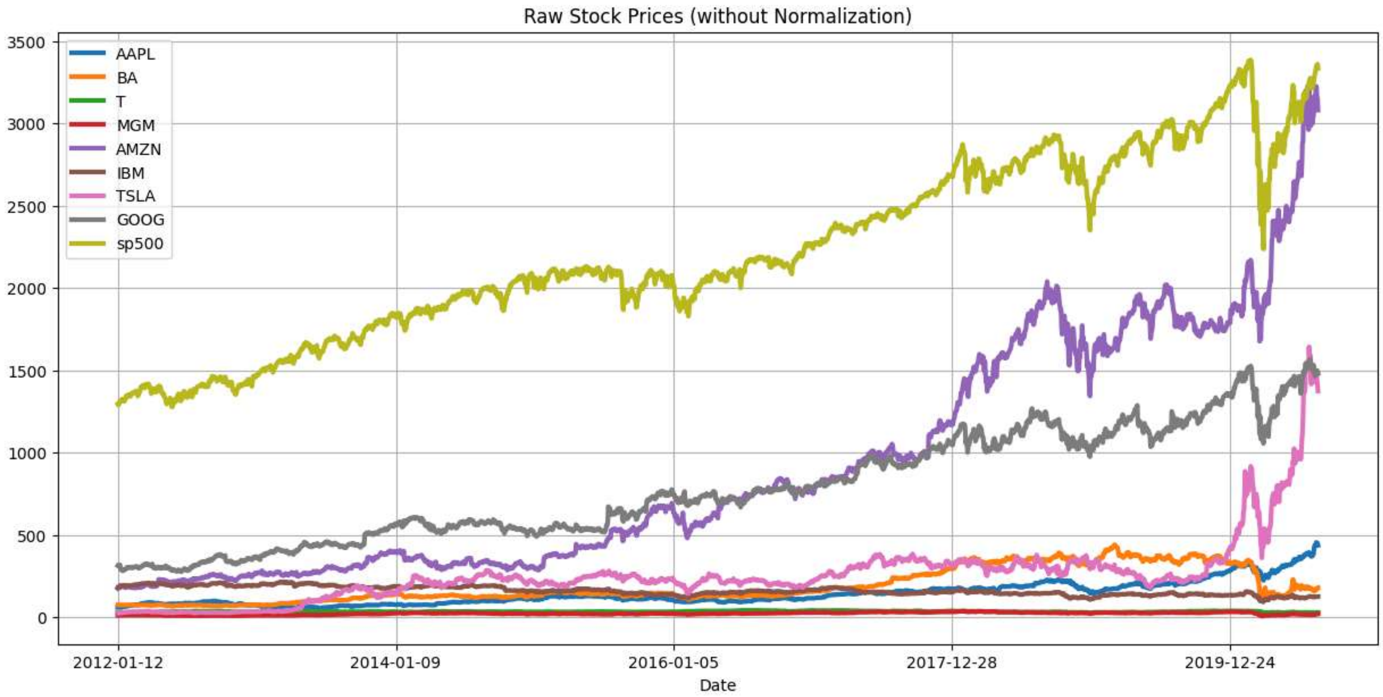
```
# Getting dataframe info & memory uses
stock_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2159 entries, 0 to 2158
Data columns (total 10 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   Date    2159 non-null   object
 1   AAPL    2159 non-null   float64
 2   BA      2159 non-null   float64
 3   T       2159 non-null   float64
 4   MGM     2159 non-null   float64
 5   AMZN    2159 non-null   float64
 6   IBM     2159 non-null   float64
 7   TSLA    2159 non-null   float64
 8   GOOG    2159 non-null   float64
 9   sp500   2159 non-null   float64
dtypes: float64(9), object(1)
memory usage: 168.8+ KB
```

```
# Plot stocks data
# Define a function to plot the entire dataframe

def show_plot(df,fig_title):
  df.plot(x= 'Date', figsize=(15,7), linewidth = 3, title=fig_title)
  plt.grid()
  plt.show()
```

+ Code + Text

```
# Plot the data
show_plot(stock_df, 'Raw Stock Prices (without Normalization)')
```



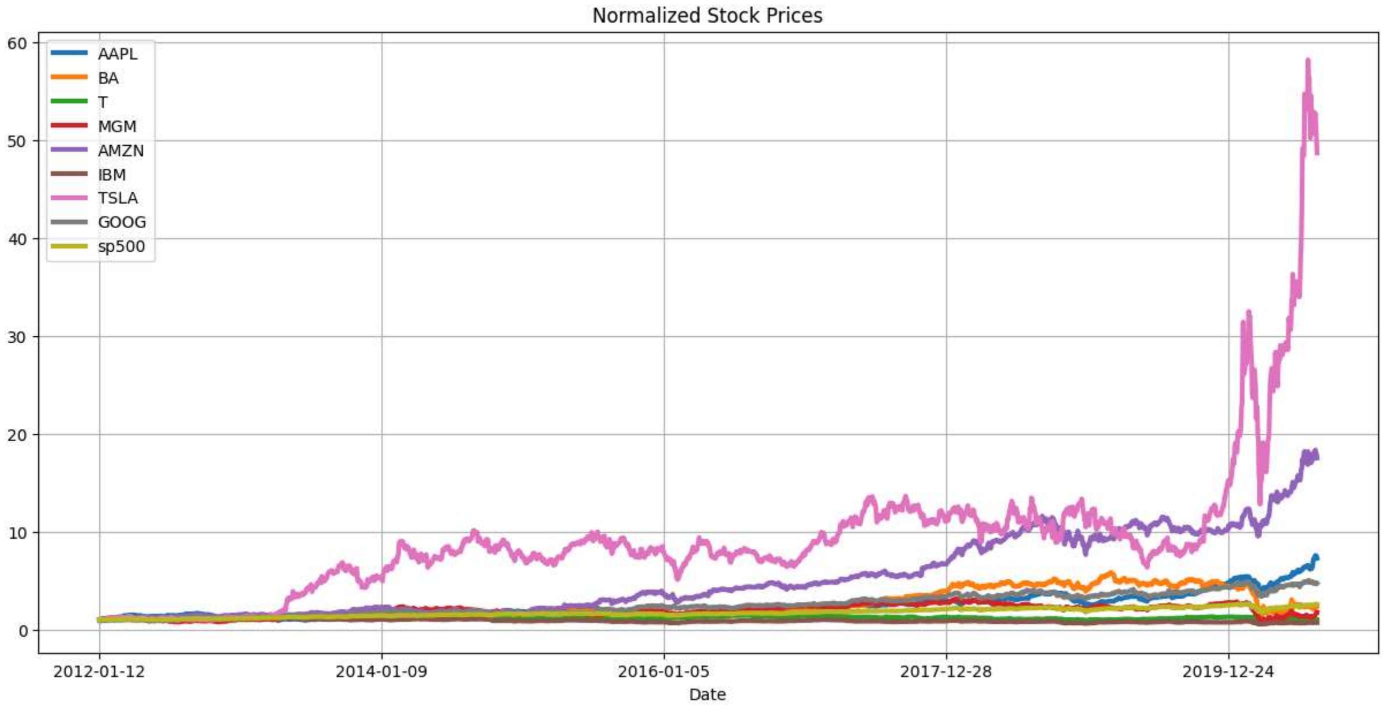
```
# Print out normalized (scaled) stock prices
# all stock price will be divided by price form index 0 to get all the price on chart start from 1

def normalize(df) :
  x = df.copy()
  for i in x.columns[1:]:
    x[i] = x[i]/x[i][0]
  return x
```

```
normalize(stock_df)
```

	Date	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
0	2012-01-12	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
1	2012-01-13	0.996251	0.987949	0.998340	1.018137	1.014153	0.992301	0.806726	0.992615	0.995052
2	2012-01-17	1.007855	0.996424	1.004316	1.009893	1.032570	0.996954	0.941593	0.998317	0.998587
3	2012-01-18	1.018320	0.994040	1.006972	1.049464	1.076792	1.002880	0.949027	1.005193	1.009680
4	2012-01-19	1.015093	1.000662	1.009960	1.055235	1.105269	0.999834	0.947257	1.015771	1.014666
...	...	...	...	...	...	...	...	...	...	...
2154	2020-08-05	7.313297	2.308039	0.991036	1.378401	18.217644	0.694821	52.567080	4.698347	2.568715
2155	2020-08-06	7.568452	2.280493	0.990704	1.521847	18.331155	0.698532	52.728494	4.782805	2.585226
2156	2020-08-07	7.383066	2.251622	0.996680	1.568838	18.004093	0.692107	51.423361	4.764919	2.586862
2157	2020-08-10	7.490377	2.375977	1.002656	1.784831	17.894390	0.704016	50.214865	4.770052	2.593956
2158	2020-08-11	7.267614	2.385512	1.002656	1.772465	17.510772	0.702022	48.650974	4.719740	2.573284

2159 rows × 10 columns

```
show_plot(normalize(stock_df), 'Normalized Stock Prices')
```



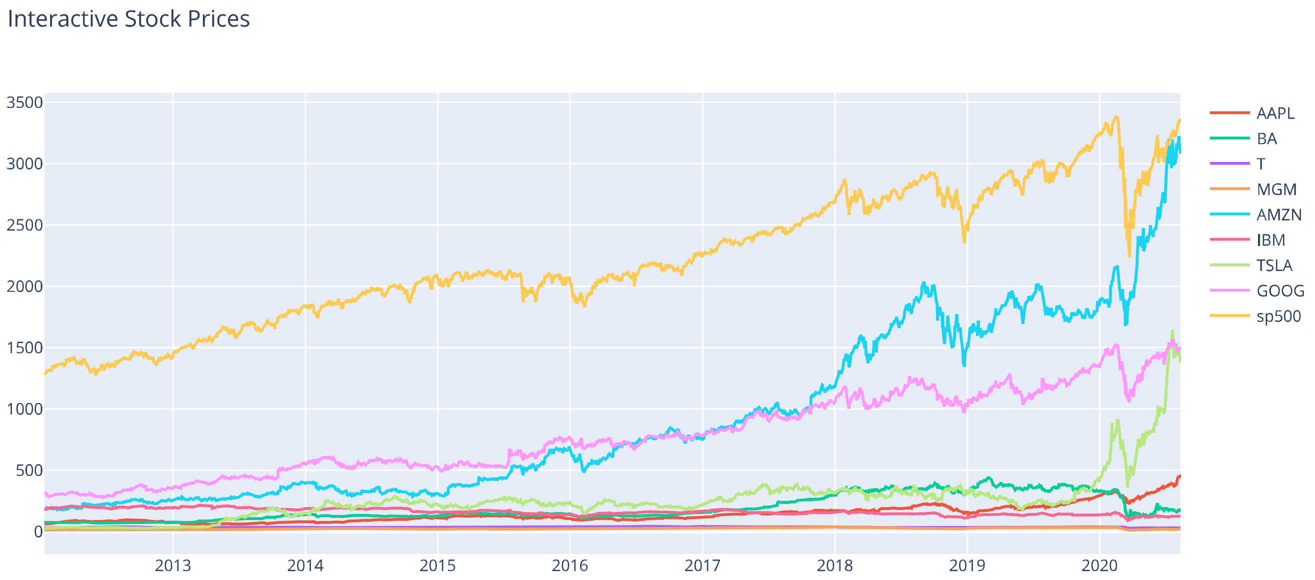
```
# Tesla and amazone showed gains of 48 % and 17 % respectively
# we can check it by calculate between first price with last price
# for Tesla, (1374.39-28.25)/28.25 x 100% = 48%
# for amazone, (3080.66-175.92)/175.92 x 100% = 17%
```

Performe Interactive Data Visualization

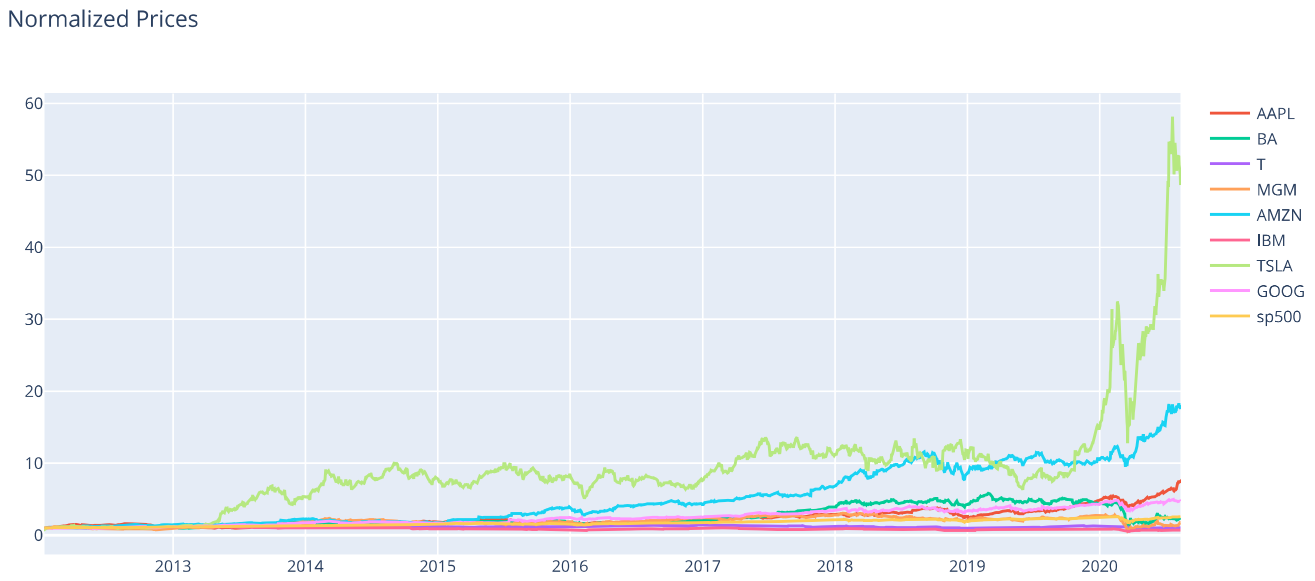
```
# use interactive data plotting using plotly.express
# note : at the beginning, i have already import library
# import plotly.express as px
# import plotly.figure_factory as ff
# import plotly.graph_objects as go
```

for more tutorial about plotly, here is a link we can follow plotly time-series chart

```
def interactive_plot(df,title) :
  fig = px.line(title=title)

  for i in df.columns[1:] :
    fig.add_scatter(x=df['Date'], y=df[i], name=i)
  fig.show()


interactive_plot(stock_df, 'Interactive Stock Prices')
```

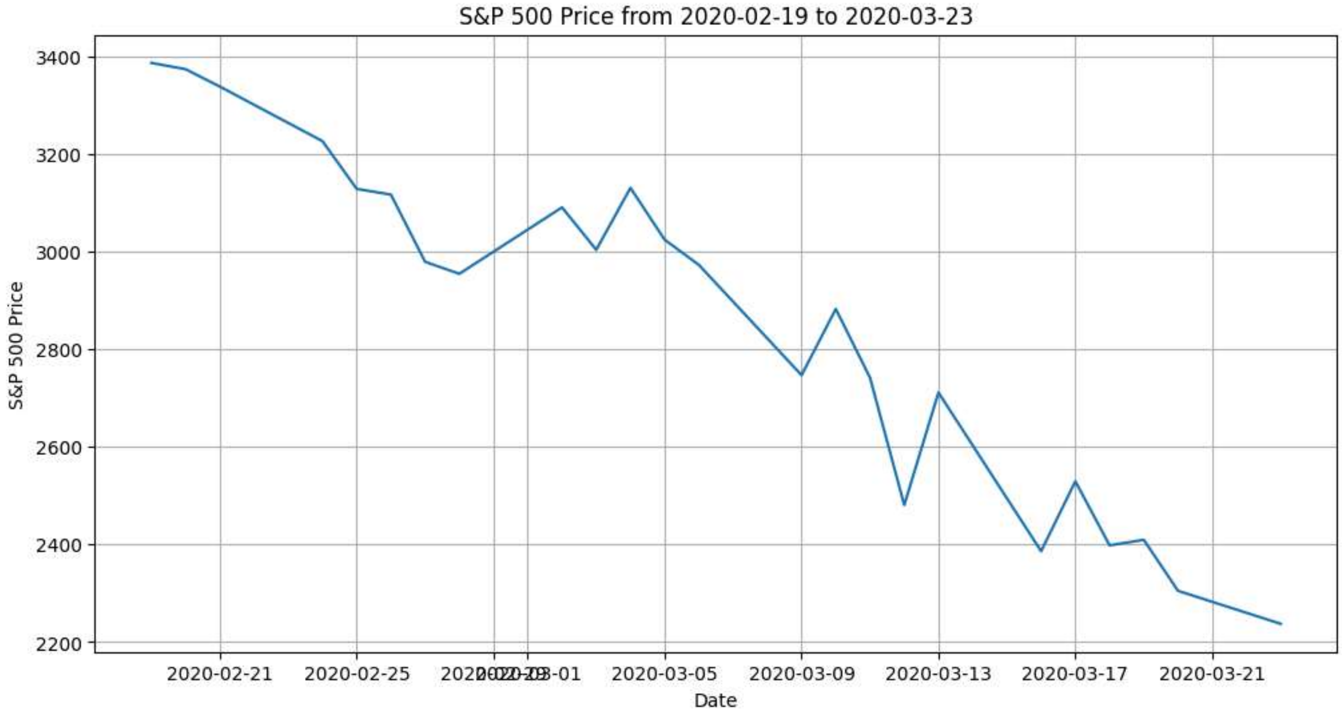


```
# Why is it said to be interactive, because when we browse the chart,
# when we place the cursor on the chart, the date will appear.
# Then we can zoom to see more details of the chart.


# lets assume we bouht 100 share of S&P500 on 19th feb 2020, how much did we lose by march 23rd, 2020 ?

interactive_plot(normalize(stock_df),'Normalized Prices')
```



```
# Assuming 'stock_df' DataFrame is already loaded as in your provided code.

# Convert 'Date' column to datetime objects
stock_df['Date'] = pd.to_datetime(stock_df['Date'])

# Filter data for the specified date range
start_date = '2020-02-19'
end_date = '2020-03-23'
filtered_df = stock_df[(stock_df['Date'] >= start_date) & (stock_df['Date'] <= end_date)]


# Extract the S&P 500 prices
sp500_prices = filtered_df['sp500']

# Print the S&P 500 prices for the specified period
print(sp500_prices)


# If you want to plot the data
plt.figure(figsize=(12, 6))
plt.plot(filtered_df['Date'], filtered_df['sp500'])
plt.xlabel('Date')
plt.ylabel('S&P 500 Price')
plt.title('S&P 500 Price from 2020-02-19 to 2020-03-23')
plt.grid(True)
plt.show()
```

```
2037    3386.149902
2038    3373.229980
2039    3337.750000
2040    3225.889893
2041    3128.209961
2042    3116.389893
2043    2978.760010
2044    2954.219971
2045    3090.229980
2046    3003.370117
2047    3130.120117
2048    3023.939941
2049    2972.370117
2050    2746.560059
2051    2882.229980
2052    2741.379883
2053    2480.639893
2054    2711.020020
2055    2386.129883
2056    2529.189941
2057    2398.100098
2058    2409.389893
2059    2304.919922
2060    2237.399902
Name: sp500, dtype: float64
```



```
# Assuming 'stock_df' DataFrame is already loaded and 'Date' column is datetime

# Specify the start and end dates
start_date = '2020-02-19'
end_date = '2020-03-23'

# Convert 'Date' to datetime if it's not already
stock_df['Date'] = pd.to_datetime(stock_df['Date'])

# Filter the DataFrame for the specified date range
filtered_df = stock_df[(stock_df['Date'] >= start_date) & (stock_df['Date'] <= end_date)]

# Get the S&P 500 prices for the start and end dates
start_price = filtered_df['sp500'].iloc[0]
end_price = filtered_df['sp500'].iloc[-1]

# Calculate the percentage loss
percentage_loss = ((end_price - start_price) / start_price) * 100

# Print the result
print(f"Percentage loss from {start_date} to {end_date}: {percentage_loss:.2f}%")
```

```
Percentage loss from 2020-02-19 to 2020-03-23: -33.92%
```

```
# we can check manually
Netloss = (2237.4-3386.15)/3386.15*100
Netloss
```

```
-33.924959024260595
```

Calculate Individual stocks daily return

```
df = stock_df['sp500']
df
```

```
            sp500
   0  1295.500000
   1  1289.089966
   2  1293.670044
   3  1308.040039
   4  1314.500000
 ...          ...
2154  3327.770020
2155  3349.159912
2156  3351.280029
2157  3360.469971
2158  3333.689941
2159 rows × 1 columns

dtype: float64
```

```
df_daily_return = df.copy()

for j in range(1, len(df)):
  df_daily_return[j] = ((df[j]/df[j-1]) / df[j-1]) * 100

df_daily_return[0] = 0
df_daily_return
```

```
         sp500
   0  0.000000
   1  0.076808
   2  0.077850
   3  0.078158
   4  0.076828
 ...       ...
2154  0.030438
2155  0.030243
2156  0.029877
2157  0.029921
2158  0.029521
2159 rows × 1 columns

dtype: float64
```

```
df = stock_df['AMZN']
df
```

```
             AMZN
   0   175.929993
   1   178.419998
   2   181.660004
   3   189.440002
   4   194.449997
 ...          ...
2154  3205.030029
2155  3225.000000
2156  3167.459961
2157  3148.159912
2158  3080.669922
2159 rows × 1 columns

dtype: float64
```

```
df_daily_return = df.copy()

for j in range(1, len(df)):
  df_daily_return[j] = ((df[j]/df[j-1]) / df[j-1]) * 100

df_daily_return[0] = 0
df_daily_return
```

```
          AMZN
   0  0.000000
   1  0.576453
   2  0.570653
   3  0.574054
   4  0.541832
 ...       ...
2154  0.032531
2155  0.031395
2156  0.030455
2157  0.031379
2158  0.031084
2159 rows × 1 columns

dtype: float64
```

```
def daily_return(df) :
  df_daily_return = df.copy()

  # loop on columns (stocks)
  for i in df.columns[1:] :

  # loop on each row
    for j in range(1, len(df)):
      df_daily_return[i][j] = ((df[i][j] - df[i][j-1]) / df[i][j-1] ) * 100
    df_daily_return[i][0] = 0
  return df_daily_return


stock_daily_returns = daily_return(stock_df)
stock_daily_returns
```

```
stock_daily_returns = daily_return(stock_df)
stock_daily_returns
```

Show hidden output

```
from google.colab import drive
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from copy import copy
from scipy import stats
import plotly.express as px
import plotly.figure_factory as ff
import plotly.graph_objects as go

# Mount the drive
drive.mount('/content/drive')

# Read the stock data csv file
# use Pandas to read the file
stock_df = pd.read_csv('/content/drive/MyDrive/PYTHON SEMUA/MASTER PYTHON for FINANCE (udemy 2 dec 2024)/Colab Notebooks/UDEMY Python for Fin

# ... (rest of your code)

def daily_return(df) :
  df_daily_return = df.copy()

  # loop on columns (stocks)
  for i in df.columns[1:] :
    # loop on each row
    for j in range(1, len(df)):
      # Calculate daily return correctly
      df_daily_return.loc[j, i] = ((df[i][j] - df[i][j-1]) / df[i][j-1] ) * 100
    df_daily_return.loc[0, i] = 0  # Set the first day's return to 0
  return df_daily_return

stock_daily_returns = daily_return(stock_df)
stock_daily_returns
```

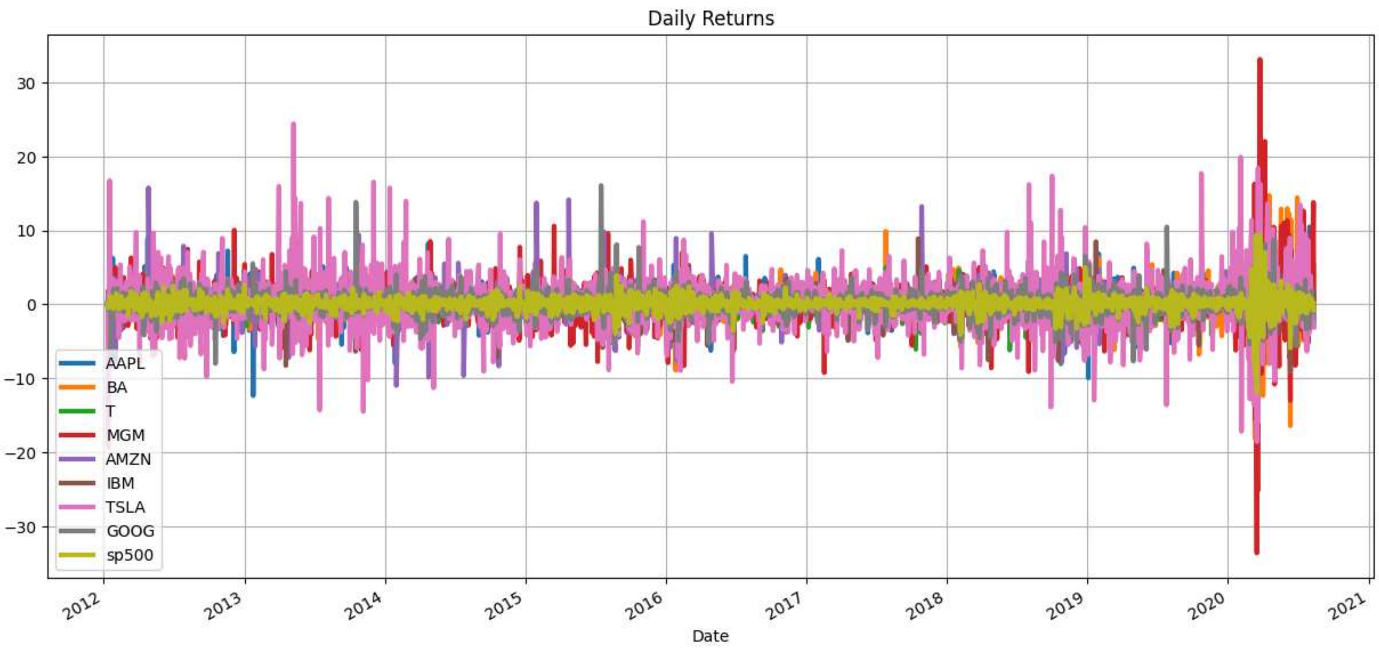
```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

	Date	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
0	2012-01-12	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1	2012-01-13	-0.374946	-1.205144	-0.166006	1.813685	1.415339	-0.769869	-19.327430	-0.738516	-0.494792
2	2012-01-17	1.164812	0.857909	0.598603	-0.809717	1.815943	0.468852	16.717854	0.574410	0.355295
3	2012-01-18	1.038382	-0.239234	0.264463	3.918367	4.282725	0.594448	0.789470	0.688856	1.110793
4	2012-01-19	-0.316937	0.666134	0.296736	0.549882	2.644634	-0.303752	-0.186494	1.052283	0.493866
...	...	...	...	...	...	...	...	...	...	...
2154	2020-08-05	0.362467	5.579446	-0.533156	0.000000	2.109065	-0.309917	-0.133153	0.589774	0.642974
2155	2020-08-06	3.488923	-1.193483	-0.033501	10.406699	0.623082	0.534082	0.307062	1.797626	0.642770
2156	2020-08-07	-2.449458	-1.265966	0.603217	3.087768	-1.784187	-0.919762	-2.475194	-0.373974	0.063303
2157	2020-08-10	1.453480	5.522880	0.599604	13.767729	-0.609323	1.720552	-2.350092	0.107728	0.274222
2158	2020-08-11	-2.973987	0.401316	0.000000	-0.692841	-2.143792	-0.283220	-3.114399	-1.054744	-0.796913

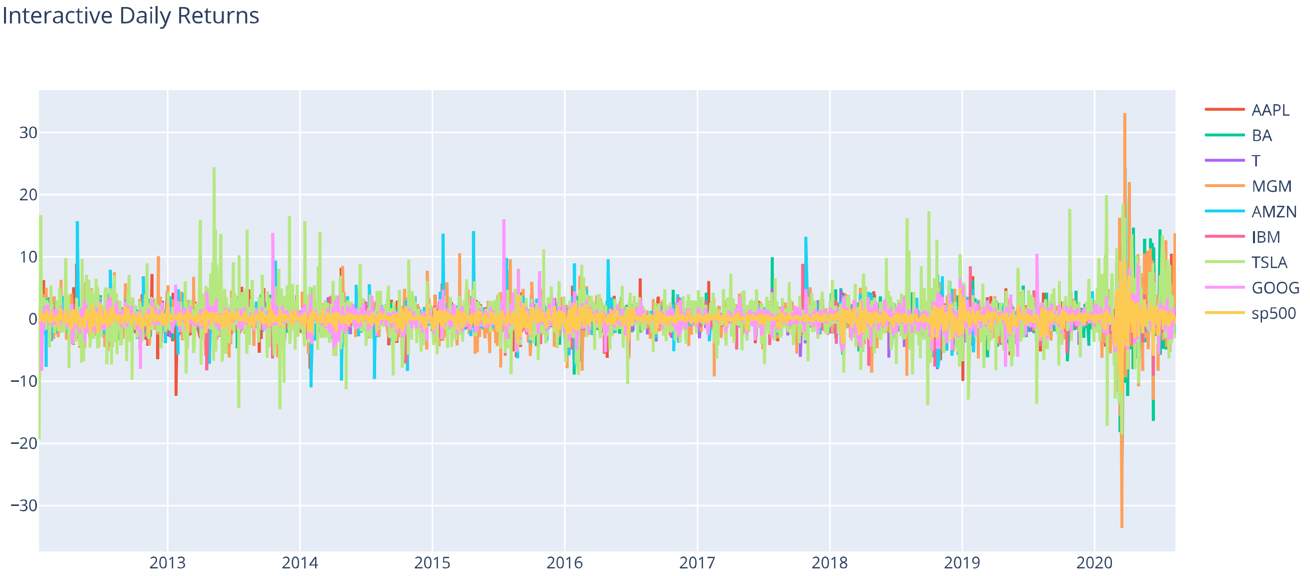
2159 rows × 10 columns

Next steps: Generate code with `stock_daily_returns` View recommended plots New interactive sheet

```
show_plot(stock_daily_returns, 'Daily Returns')
```



```
interactive_plot(stock_daily_returns, 'Interactive Daily Returns')
```



Calculate the correlations between daily return

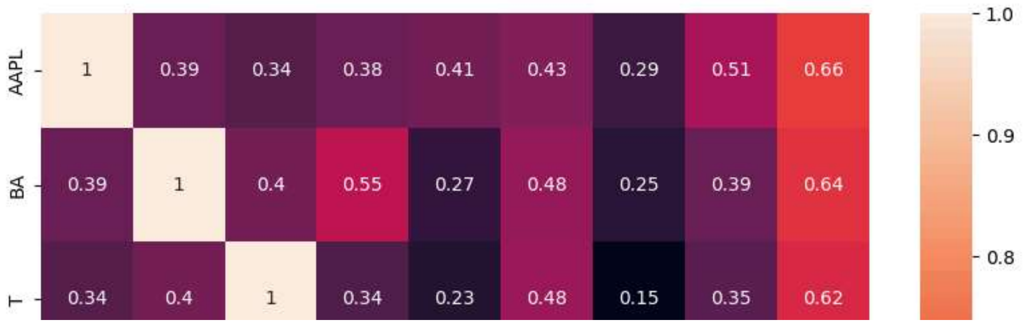
```
# Using corr method
cm = stock_daily_returns.corr()
cm
```

	Date	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
Date	1.000000	0.024603	-0.012913	-0.015119	-0.008173	0.007606	-0.002416	0.003580	-0.001927	-0.001720
AAPL	0.024603	1.000000	0.385250	0.341373	0.384089	0.410234	0.434534	0.288535	0.509125	0.657321
BA	-0.012913	0.385250	1.000000	0.401602	0.554229	0.267466	0.479264	0.250946	0.388048	0.641826
T	-0.015119	0.341373	0.401602	1.000000	0.340166	0.233145	0.484219	0.152515	0.353695	0.617463
MGM	-0.008173	0.384089	0.554229	0.340166	1.000000	0.309016	0.441631	0.311879	0.439142	0.631449
AMZN	0.007606	0.410234	0.267466	0.233145	0.309016	1.000000	0.339589	0.310084	0.575284	0.539560
IBM	-0.002416	0.434534	0.479264	0.484219	0.441631	0.339589	1.000000	0.245609	0.458816	0.703935
TSLA	0.003580	0.288535	0.250946	0.152515	0.311879	0.310084	0.245609	1.000000	0.322805	0.387921
GOOG	-0.001927	0.509125	0.388048	0.353695	0.439142	0.575284	0.458816	0.322805	1.000000	0.684572
sp500	-0.001720	0.657321	0.641826	0.617463	0.631449	0.539560	0.703935	0.387921	0.684572	1.000000

```
# we have to drop Date column from dataframe
cm = stock_daily_returns.drop(columns = ['Date']).corr()
cm
```

	AAPL	BA	T	MGM	AMZN	IBM	TSLA	GOOG	sp500
AAPL	1.000000	0.385250	0.341373	0.384089	0.410234	0.434534	0.288535	0.509125	0.657321
BA	0.385250	1.000000	0.401602	0.554229	0.267466	0.479264	0.250946	0.388048	0.641826
T	0.341373	0.401602	1.000000	0.340166	0.233145	0.484219	0.152515	0.353695	0.617463
MGM	0.384089	0.554229	0.340166	1.000000	0.309016	0.441631	0.311879	0.439142	0.631449
AMZN	0.410234	0.267466	0.233145	0.309016	1.000000	0.339589	0.310084	0.575284	0.539560
IBM	0.434534	0.479264	0.484219	0.441631	0.339589	1.000000	0.245609	0.458816	0.703935
TSLA	0.288535	0.250946	0.152515	0.311879	0.310084	0.245609	1.000000	0.322805	0.387921
GOOG	0.509125	0.388048	0.353695	0.439142	0.575284	0.458816	0.322805	1.000000	0.684572
sp500	0.657321	0.641826	0.617463	0.631449	0.539560	0.703935	0.387921	0.684572	1.000000

```
plt.figure(figsize=(10,10))
sns.heatmap(cm, annot=True) # to display the numbers on the heatmap, put True into the annotation
plt.show()
```



The heatmap visualizes the correlation matrix of daily returns for various stocks. Each square in the heatmap represents the correlation coefficient between the daily returns of two different stocks.

- **Values:** The color intensity of each square corresponds to the correlation coefficient, ranging from -1 (perfect negative correlation) to +1 (perfect positive correlation). Values close to 0 indicate weak or no linear correlation.
- **Interpretation:**
    - A bright square (closer to +1) indicates a strong positive correlation. When one stock's daily return goes up, the other's tends to go up as well.
    - A dark square (closer to -1) indicates a strong negative correlation. When one stock's daily return increases, the other's tends to decrease.
    - A square near the middle (closer to 0) indicates a weak or no linear relationship between the two stocks' daily returns.
- **Diagonal:** The diagonal line from top-left to bottom-right will always be bright, with correlation coefficients of 1. This is because each stock is perfectly correlated with itself.
- **Symmetry:** The heatmap is symmetrical across the diagonal. The correlation between Stock A and Stock B is the same as the correlation between Stock B and Stock A.
- **Context:** In this specific example, the heatmap shows the correlations between the daily returns of stocks like AAPL (Apple), BA (Boeing), T (AT&T), MGM, IBM, TSLA (Tesla), GOOG (Google), and the S&P 500 index. This allows an investor to see how the daily price movements of these stocks relate to each other. Highly correlated stocks may tend to react similarly to market events, while uncorrelated stocks can offer diversification benefits in a portfolio.

```
# Calculate the correlation of each stock with the S&P 500
correlations = stock_daily_returns.drop(columns=['Date']).corr()['sp500']

# Remove the self-correlation (sp500 with sp500)
correlations = correlations.drop('sp500')

# Find the stock with the highest correlation to the S&P 500
most_correlated_stock = correlations.abs().idxmax()
correlation_value = correlations[most_correlated_stock]
```