```
[1] #Description: This program uses the three moving average crossover strategy
    #             to determine when to buy and sell stock
```

```
[2] #Import the libraries
    import pandas as pd
    import numpy as np
    import matplotlib.pyplot as plt
    plt.style.use('fivethirtyeight')
```

```
[3] #Load the data
    from google.colab import files
    uploaded = files.upload()
```

Choose Files TSLA.csv

- **TSLA.csv**(application/vnd.ms-excel) - 90039 bytes, last modified: 7/22/2021 - 100% done

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Saving TSLA.csv to TSLA.csv
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```
[4] #Store the data into a variable
    df = pd.read_csv('TSLA.csv')

    #Set the index
    df = df.set_index(pd.DatetimeIndex(df['Date'].values))

    #Show the data
    df
```

	Date	Open	High	Low	Close	Adj Close	Volume
2016-07-22	2016-07-22	44.397999	44.900002	43.776001	44.453999	44.453999	12898500
2016-07-25	2016-07-25	44.453999	46.278000	44.273998	46.001999	46.001999	22453500
2016-07-26	2016-07-26	45.537998	46.000000	45.060001	45.902000	45.902000	17150000
2016-07-27	2016-07-27	45.868000	46.672001	45.383999	45.698002	45.698002	14445000
2016-07-28	2016-07-28	45.590000	46.152000	45.320000	46.122002	46.122002	12095500
...	...	...	...	...	...	...	...
2021-07-15	2021-07-15	658.390015	666.140015	637.880005	650.599976	650.599976	20209600
2021-07-16	2021-07-16	654.679993	656.700012	642.200012	644.219971	644.219971	16339800
2021-07-19	2021-07-19	629.890015	647.200012	621.289978	646.219971	646.219971	21297100
2021-07-20	2021-07-20	651.989990	662.390015	640.500000	660.500000	660.500000	15442700
2021-07-21	2021-07-21	659.609985	664.859985	650.289978	655.289978	655.289978	13910800

1258 rows × 7 columns

```
[5] #Visually show the close price
    plt.figure(figsize=(12.2, 6))
    plt.title('Close Price', fontsize =18)
    plt.plot(df['Close'])
    plt.xlabel('Date', fontsize = 18)
    plt.ylabel('Close Price', fontsize = 18)
    plt.show()
```


```
[6] #Calculate the three moving averages
    #Calculate the short/fast exponential moving average
    ShortEMA = df.Close.ewm(span=5, adjust=False).mean()
    #Calculate the Middle/Medium exponential moving average
    MiddleEMA = df.Close.ewm(span=21, adjust=False).mean()
    #Calculate the long/slow exponential moving average
    LongEMA = df.Close.ewm(span=63, adjust = False).mean()
```

```
[7] #Visualize the closing price and the exponential moving averages
    plt.figure(figsize=(18, 10))
    plt.title('Close Price', fontsize = 18)
    plt.plot(df['Close'], label= 'Close Price', color= 'blue')
    plt.plot(ShortEMA, label = 'Short/Fast EMA', color='red')
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plt.plot(MiddleEMA, label = 'Middle/Medium EMA' , color= 'orange' )
plt.plot(LongEMA, label='Long/Slow EMA', color='green')
plt.xlabel('Date', fontsize = 18)
plt.ylabel('Close Price', fontsize = 18)
plt.show()
```
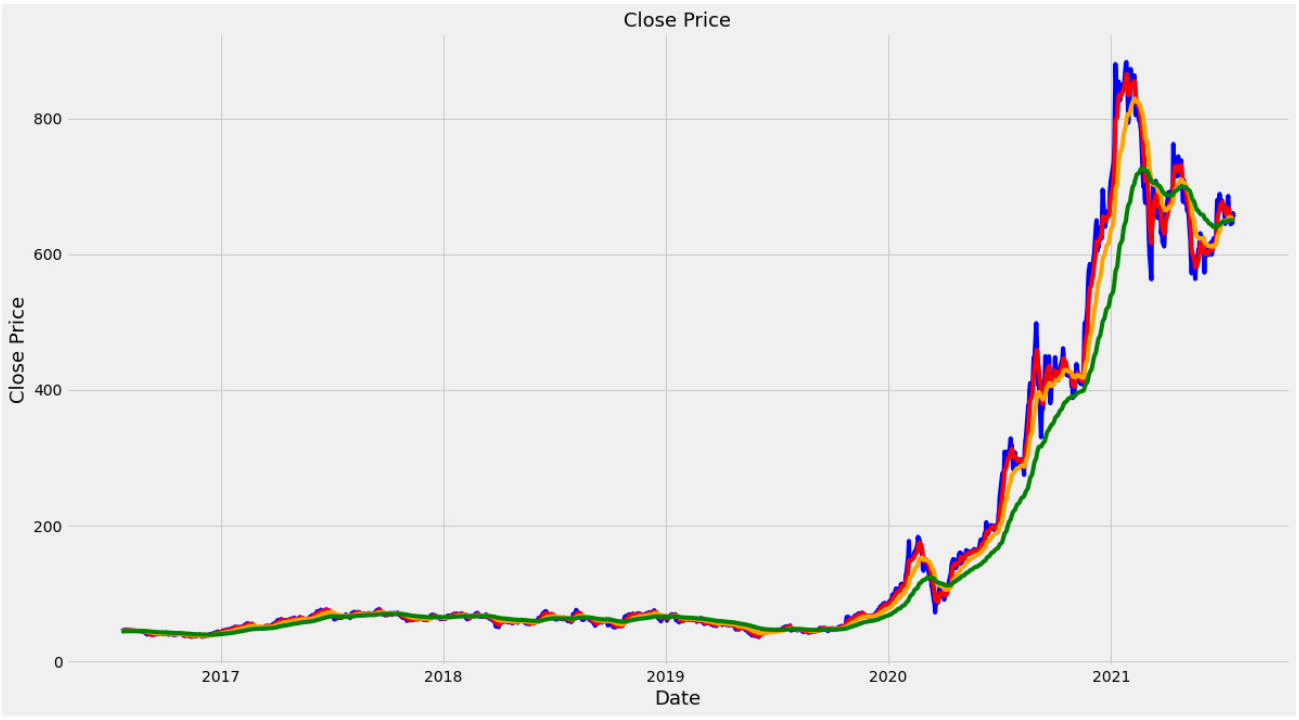



[8]
```
#Add the exponential moving averages to the data set
df['Short'] = ShortEMA
df['Middle']= MiddleEMA
df['Long']= LongEMA
```

[9]
```
#Show the data
df
```

	Date	Open	High	Low	Close	Adj Close	Volume	Short	Middle	Long
2016-07-22	2016-07-22	44.397999	44.900002	43.776001	44.453999	44.453999	12898500	44.453999	44.453999	44.453999
2016-07-25	2016-07-25	44.453999	46.278000	44.273998	46.001999	46.001999	22453500	44.969999	44.594726	44.502374
2016-07-26	2016-07-26	45.537998	46.000000	45.060001	45.902000	45.902000	17150000	45.280666	44.713569	44.546112
2016-07-27	2016-07-27	45.868000	46.672001	45.383999	45.698002	45.698002	14445000	45.419778	44.803063	44.582109
2016-07-28	2016-07-28	45.590000	46.152000	45.320000	46.122002	46.122002	12095500	45.653853	44.922967	44.630231
...	...	...	...	...	...	...	...	...	...	...
2021-07-15	2021-07-15	658.390015	666.140015	637.880005	650.599976	650.599976	20209600	658.871649	653.992862	650.204036
2021-07-16	2021-07-16	654.679993	656.700012	642.200012	644.219971	644.219971	16339800	653.987756	653.104417	650.017034
2021-07-19	2021-07-19	629.890015	647.200012	621.289978	646.219971	646.219971	21297100	651.398494	652.478558	649.898376
2021-07-20	2021-07-20	651.989990	662.390015	640.500000	660.500000	660.500000	15442700	654.432330	653.207780	650.229677
2021-07-21	2021-07-21	659.609985	664.859985	650.289978	655.289978	655.289978	13910800	654.718212	653.397071	650.387811

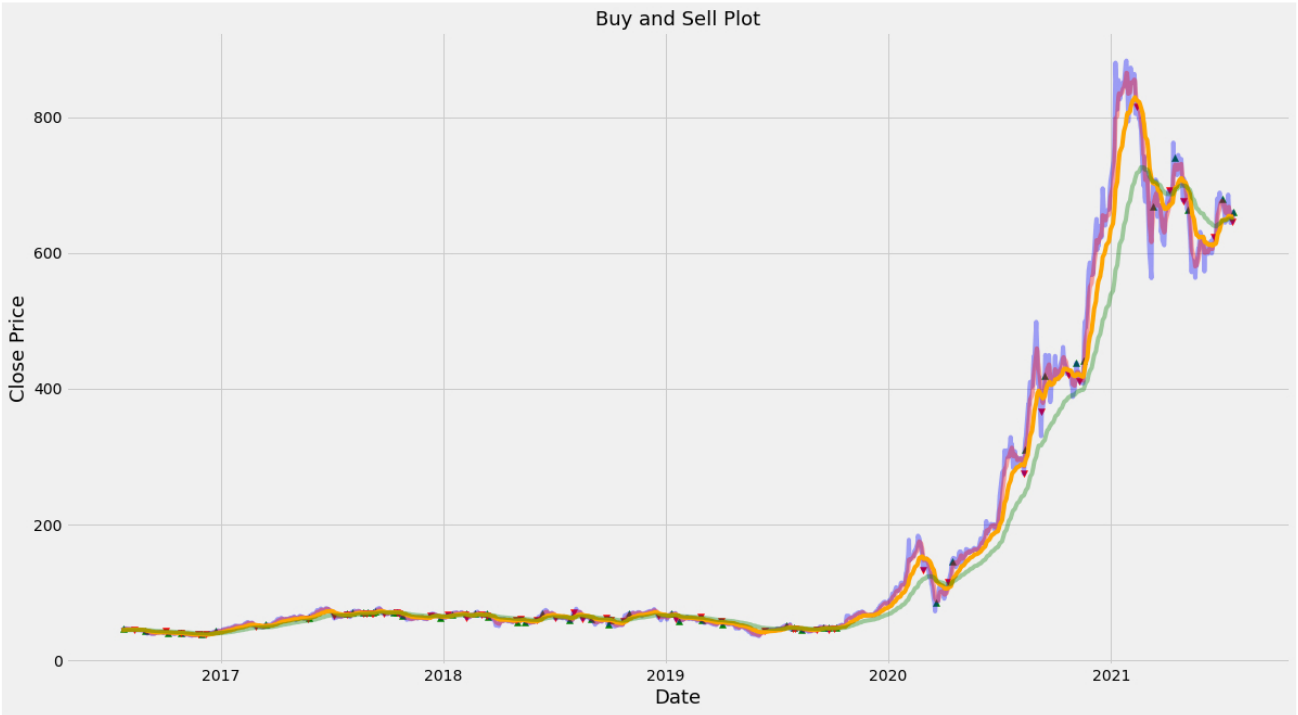
1258 rows × 10 columns

[11]
```
#Create the function to buy and sell the stock
def buy_sell_function(data):

  buy_list = []
  sell_list = []
  flag_long = False
  flag_short = False

  for i in range(0, len(data)):
    if data['Middle'][i] < data['Long'][i] and data['Short'][i] < data['Middle'][i] and flag_long == False and flag_short == False:
      buy_list.append(data['Close'][i])
      sell_list.append(np.nan)
      flag_short = True
    elif flag_short == True and data['Short'][i] > data['Middle'][i]:
      sell_list.append(data['Close'][i])
      buy_list.append(np.nan)
      flag_short = False

    elif data['Middle'][i] > data['Long'][i] and data['Short'][i] > data['Middle'][i] and flag_long == False and flag_short == False:
      buy_list.append(data['Close'][i])
      sell_list.append(np.nan)
      flag_long = True
    elif flag_long == True and data['Short'][i] < data['Middle'][i]:
      sell_list.append(data['Close'][i])
      buy_list.append(np.nan)
      flag_long = False

    else:
      buy_list.append(np.nan)
      sell_list.append(np.nan)
  return (buy_list, sell_list)
```

```
    return (buy_list, sell_list)
```

[12]
```
#Add the buy and sell signals to the data set
df['Buy']= buy_sell_function(df)[0]
df['Sell'] = buy_sell_function(df)[1]
```

```
#Visually show the stock buy and sell signals

plt.figure(figsize=(18, 10))
plt.title('Buy and Sell Plot', fontsize = 18)
plt.plot(df['Close'], label= 'Close Price', color= 'blue', alpha=0.35)
plt.plot(ShortEMA, label = 'Short/Fast EMA', color='red', alpha=0.35)
plt.plot(MiddleEMA, label ='Middle/Medium EMA', color='orange')
plt.plot(LongEMA, label='Long/Slow EMA', color='green', alpha=0.35)
plt.scatter(df.index, df['Buy'], color='green', marker='^', alpha=1)
plt.scatter(df.index, df['Sell'], color='red', marker='v', alpha=1)
plt.xlabel('Date', fontsize = 18)
plt.ylabel('Close Price', fontsize = 18)
plt.show()
```



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