```
#this program uses the dual moving average crossover to determine when to buy and sell
#If the moving average of 30 days is greater than the moving average of 100 days, then we sta
#and viceversa
```

```
#import the libraries
import pandas as pd
import numpy as np
from datetime import datetime
import matplotlib.pyplot as plt
plt.style.use('fivethirtyeight')
```

```
#store the data from csv
SAAPL = pd.read_csv('D:\DS\Data\movingaverage.csv')
```

SAAPL

	Date	Open	High	Low	Close	Volume	AdjClose
0	10/14/2008	116.26	116.40	103.14	104.08	70749800	104.08
1	10/13/2008	104.55	110.53	101.02	110.26	54967000	110.26
2	10/10/2008	85.70	100.00	85.00	96.80	79260700	96.80
3	10/9/2008	93.35	95.80	86.60	88.74	57763700	88.74
4	10/8/2008	85.91	96.33	85.68	89.79	78847900	89.79
...	...	...	...	...	...	...	...
6076	9/13/1984	27.50	27.62	27.50	27.50	7429600	3.14
6077	9/12/1984	26.87	27.00	26.12	26.12	4773600	2.98
6078	9/11/1984	26.62	27.37	26.62	26.87	5444000	3.07

```
plt.figure(figsize= (12.5, 4.5))
plt.plot(SAAPL['AdjClose'], label = 'SAAPL')
plt.title('Adj Close price History')
plt.xlabel('Sept, 1984 - Oct 2008')
```

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plt.ylabel('Adjusted Close Price $')
plt.legend(loc='upper left')
plt.show()
```


```
#Create the moving average with a 30 day window

DF30 = pd.DataFrame()

DF30['SMA30'] = SAAPL['AdjClose'].rolling(window=30).mean()

DF30
```

	SMA30
0	NaN
1	NaN

```
#Create the moving average with a 100 day window

DF100 =pd.DataFrame()
DF100['SMA100'] = SAAPL['AdjClose'].rolling(window=100).mean()

DF100
```

	SMA100
0	NaN
1	NaN
2	NaN
3	NaN
4	NaN
...	...
6076	3.0145
6077	3.0109
6078	3.0089
6079	3.0059
6080	3.0020

6081 rows × 1 columns

```
#Visualize the data

plt.figure(figsize= (12.5, 10.5))
plt.plot(SAAPL['AdjClose'], label = 'SAAPL')
plt.plot(DF30['SMA30'], label = 'SMA30')
plt.plot(DF100['SMA100'], label = 'SMA100')
plt.title('Adj Close price History')
plt.xlabel('Sept, 1984 - Oct 2008')
plt.ylabel('Adjusted Close Price $')
plt.legend(loc='upper left')
plt.show()
```


```
#create a new data frame to store all the data

df= pd.DataFrame()
df['ADJPR'] = SAAPL['AdjClose']
df['SMA30'] = DF30['SMA30']
df['SMA100'] = DF100['SMA100']
```

```
df
```

```
#create a function to signal when to buy and sell
def buy_sell(df):
 sigPriceBuy = []
 sigPriceSell = []

 flag = -1

 for i in range(len(df)):



    if df['SMA30'][i] > df['SMA100'][i]:
      if flag != 1:
          sigPriceBuy.append(df['ADJPR'][i])
          sigPriceSell.append(np.nan)

          flag = 1

      else:
          sigPriceBuy.append(np.nan)
          sigPriceSell.append(np.nan)

    elif df['SMA30'][i] < df['SMA100'][i]:

      if flag != 0:
          sigPriceBuy.append(np.nan)
          sigPriceSell.append(df['ADJPR'][i])
          flag = 0

      else:
          sigPriceBuy.append(np.nan)
          sigPriceSell.append(np.nan)

    else:
          sigPriceBuy.append(np.nan)
          sigPriceSell.append(np.nan)

 return (sigPriceBuy, sigPriceSell)







#store the buy sell data into variable


buy_sell = buy_sell(df)
```

```
df['Buy_Price'] = buy_sell[0]
df['Sell_Price'] = buy_sell[1]
```

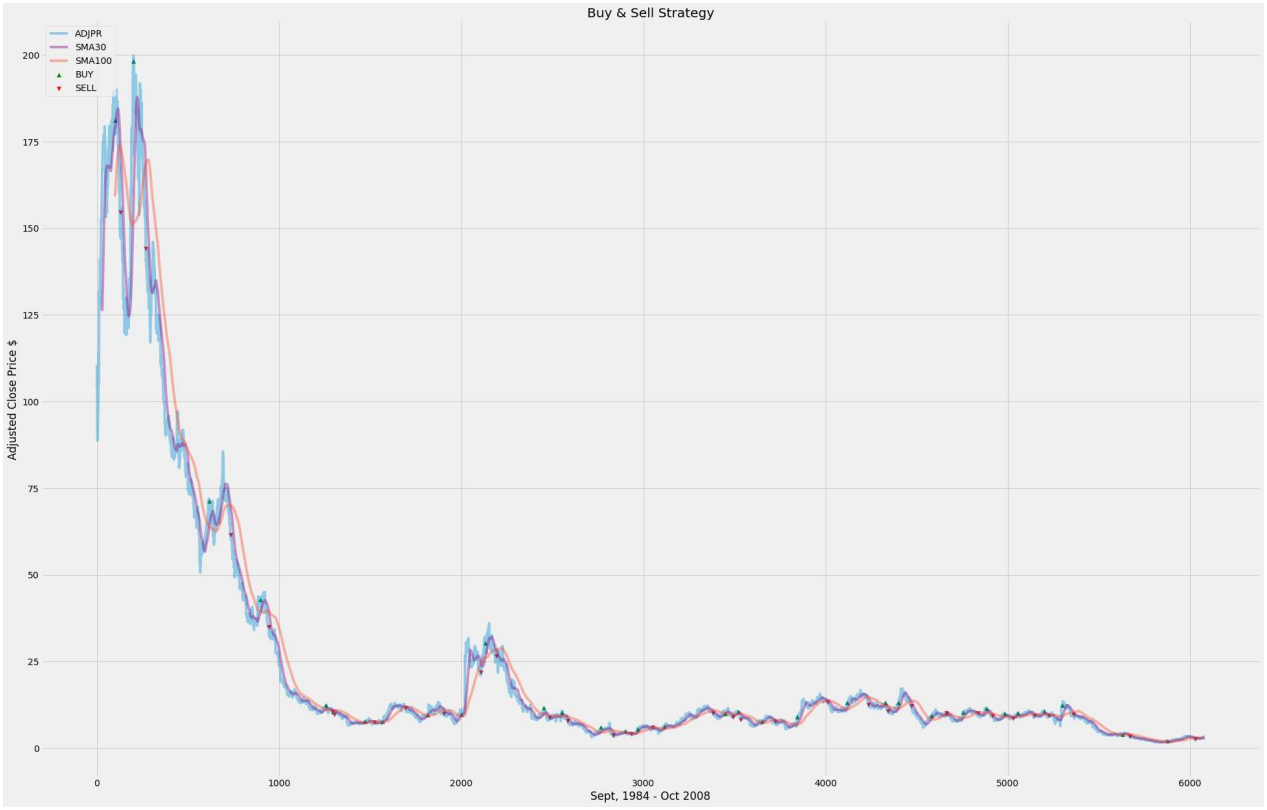
```
df
```

	ADJPR	SMA30	SMA100	Buy_Price	Sell_Price
0	104.08	NaN	NaN	NaN	NaN
1	110.26	NaN	NaN	NaN	NaN
2	96.80	NaN	NaN	NaN	NaN
3	88.74	NaN	NaN	NaN	NaN
4	89.79	NaN	NaN	NaN	NaN
...	...	...	...	...	...
6076	3.14	2.921667	3.0145	NaN	NaN
6077	2.98	2.921000	3.0109	NaN	NaN
6078	3.07	2.924333	3.0089	NaN	NaN
6079	3.01	2.928333	3.0059	NaN	NaN
6080	3.02	2.931667	3.0020	NaN	NaN

6081 rows × 5 columns

```
#Visualize the data and the strategy to buy & sell the stock

plt.figure(figsize=(30, 20))
plt.plot(df['ADJPR'], label = 'ADJPR', alpha =0.40)
plt.plot(df['SMA30'], label = 'SMA30', alpha =0.40, color ='purple')
plt.plot(df['SMA100'], label = 'SMA100', alpha =0.40)
plt.scatter(df.index, df['Buy_Price'], label = 'BUY', marker ='^', color = 'green')
plt.scatter(df.index, df['Sell_Price'], label = 'SELL', marker ='v', color = 'red')
plt.title('Buy & Sell Strategy')
plt.xlabel('Sept, 1984 - Oct 2008')
plt.ylabel('Adjusted Close Price $')
plt.legend(loc='upper left')
plt.show()
```


Buy & Sell Strategy
ADJPR
SMA30
SMA100
BUY
SELL
Adjusted Close Price $
Sept, 1984 - Oct 2008
0
25
50
75
100
125
150
175
200
0
1000
2000
3000
4000
5000
6000