In [21]:

```
import pandas as pd
df = pd.read_csv("HDFCBANK.csv")
#df.columns=['Date', 'Open', 'High', 'Low', 'Close', 'Volume']
#Check if NA values are in data
df=df[df['Volume']!=0]
df.reset_index(drop=True, inplace=True)
df.isna().sum()
df.head(10)
```

Out[21]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2013-01-01	341.049988	342.549988	339.825012	342.250000	315.591309	2014606.0
1	2013-01-02	344.950012	345.000000	341.524994	343.674988	316.905304	4854798.0
2	2013-01-03	345.000000	345.000000	340.200012	341.674988	315.061035	4571366.0
3	2013-01-04	342.500000	342.500000	336.399994	339.674988	313.216827	5442254.0
4	2013-01-07	341.850006	341.850006	333.000000	334.100006	308.076141	5502284.0
5	2013-01-08	334.000000	336.700012	332.850006	335.125000	309.021332	4942598.0
6	2013-01-09	336.000000	336.274994	333.024994	333.750000	307.753387	6435982.0
7	2013-01-10	334.750000	339.000000	333.250000	337.899994	311.580109	4565184.0
8	2013-01-11	338.450012	338.450012	333.350006	334.649994	308.583313	5141714.0
9	2013-01-14	334.075012	335.250000	333.549988	334.649994	308.583313	5694874.0

```
Head and shoulders pattern
```

In [22]:

```
def pivotid(df1, l, n1, n2): #n1 n2 before and after candle l
    if l-n1 < 0 or l+n2 >= len(df1):
        return 0

    pividlow=1
    pividhigh=1
    for i in range(l-n1, l+n2+1):
        if(df1.Low[l]>df1.Low[i]):
            pividlow=0
        if(df1.High[l]<df1.High[i]):
            pividhigh=0
    if pividlow and pividhigh:
        return 3
    elif pividlow:
        return 1
    elif pividhigh:
        return 2
    else:
        return 0

df['pivot'] = df.apply(lambda x: pivotid(df, x.name,20,20), axis=1)
df['shortpivot'] = df.apply(lambda x: pivotid(df, x.name,8,8), axis=1)
```

In [23]:

```
import numpy as np
def pointpos(x):
    if x['pivot']==1:
        return x['Low']-25
    elif x['pivot']==2:
        return x['High']+25
    else:
        return np.nan

def shortpointpos(x):
    if x['shortpivot']==1:
        return x['Low']-75
    elif x['shortpivot']==2:
        return x['High']+75
    else:
        return np.nan

df['pointpos'] = df.apply(lambda row: pointpos(row), axis=1)
df['shortpointpos'] = df.apply(lambda row: shortpointpos(row), axis=1)
```

In [24]:

```
import plotly.graph_objects as go
from plotly.subplots import make_subplots
from datetime import datetime
dfpl = df[-1000:]
fig = go.Figure(data=[go.Candlestick(x=dfpl.index,
                open=dfpl['Open'],
                high=dfpl['High'],
                low=dfpl['Low'],
                close=dfpl['Close'])])

fig.add_scatter(x=dfpl.index, y=dfpl['pointpos'], mode="markers",
                marker=dict(size=5, color="MediumPurple"),
                name="pivot")
fig.add_scatter(x=dfpl.index, y=dfpl['shortpointpos'], mode="markers",
                marker=dict(size=5, color="red"),
                name="shortpivot")
fig.update_layout(xaxis_rangeslider_visible=False)
fig.show()
```

In [ ]:

```
The purple coloured dots denote strong pivots and the red coloured dots denote weak pivo
```

MACD

In [27]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from pathlib import Path
from warnings import simplefilter
import yfinance as yf
```

In [28]:

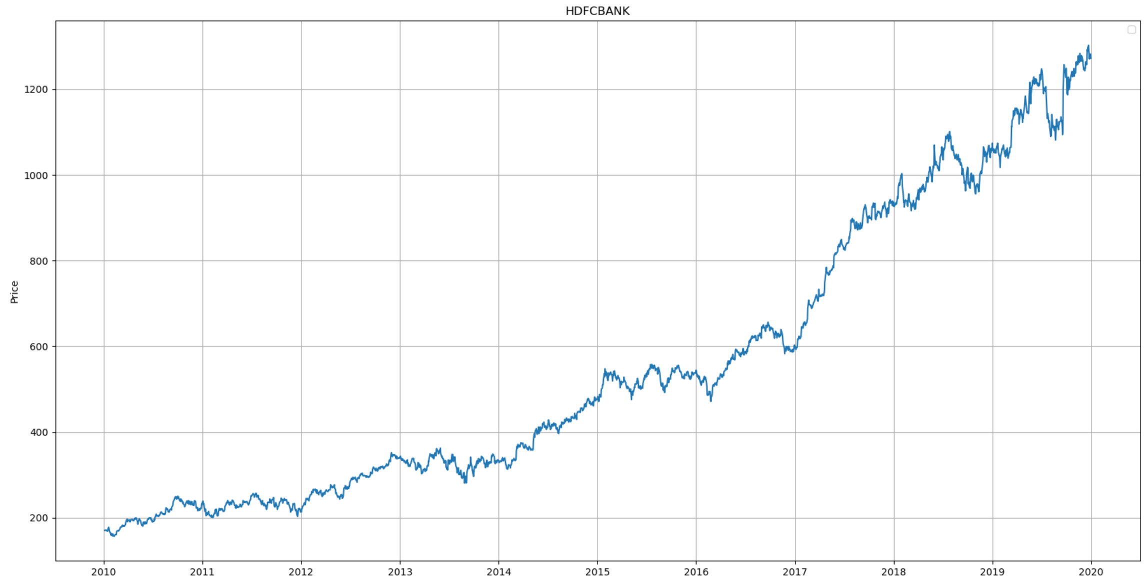
```
data=yf.download('HDFCBANK.NS', start="2010-01-01", end="2020-01-01")
```

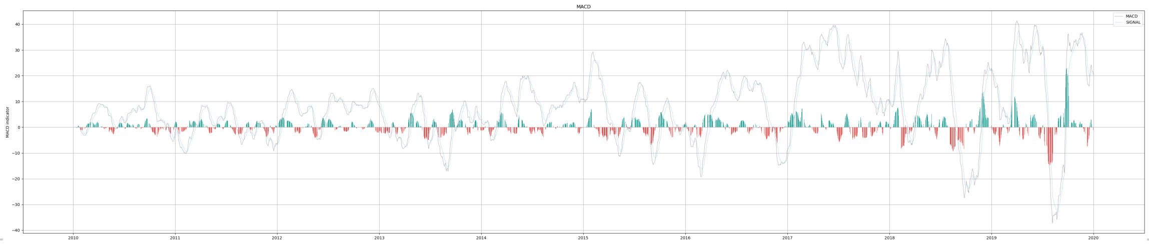
```
[*********************100%***********************]  1 of 1 completed
```

In [59]:

```
data['MACD']=data['Close'].ewm(span=15).mean()-data['Close'].ewm(span=50).mean()
data['Signal']=data['MACD'].ewm(span=10).mean()
data['Histogram']=data['MACD']-data['Signal']

plt.figure(figsize=(20, 10))
plt.plot(data['Close'])


plt.legend(loc = 'lower right')
plt.ylabel('Price')
plt.title('HDFCBANK')
plt.legend()
plt.grid(True)
plt.show()

plt.figure(figsize=(50, 10))
plt.plot(data['MACD'], color = 'grey', linewidth = 0.5, label = 'MACD')
plt.plot(data['Signal'], color = 'skyblue', linewidth = 0.5, label = 'SIGNAL')

for i in range(len(data['Histogram'])):
    if str(data['Histogram'][i])[0] == '-':
        plt.bar(data['Close'].index[i], data['Histogram'][i], color = '#ef5350')
    else:
        plt.bar(data['Close'].index[i], data['Histogram'][i], color = '#26a69a')

plt.legend(loc = 'lower right')
plt.ylabel('MACD indicator')
plt.title('MACD')
plt.legend()
plt.grid(True)
plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose la
bel start with an underscore are ignored when legend() is called with no a
rgument.
No artists with labels found to put in legend.  Note that artists whose la
bel start with an underscore are ignored when legend() is called with no a
rgument.
```

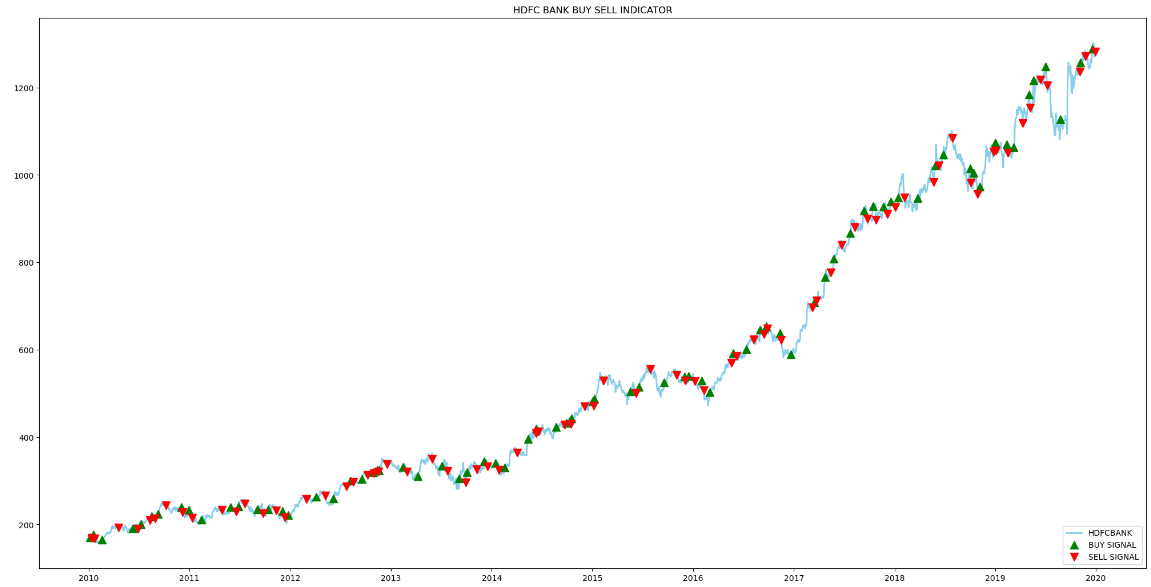


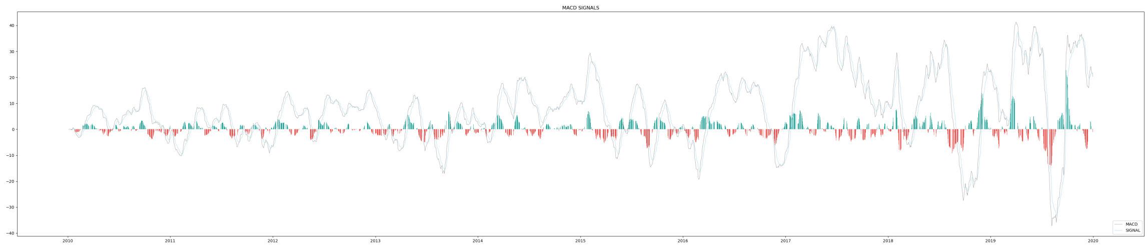


```
def implement_macd_strategy(data):
    buy_price = []
    sell_price = []
    macd_signal = []
    signal = 0

    for i in range(len(data)):
        if data['MACD'][i] > data['Signal'][i]:
            if signal != 1:
                buy_price.append(data['Close'][i])
                sell_price.append(np.nan)
                signal = 1
                macd_signal.append(signal)
            else:
                buy_price.append(np.nan)
                sell_price.append(np.nan)
                macd_signal.append(0)
        elif data['MACD'][i] < data['Signal'][i]:
            if signal != -1:
                buy_price.append(np.nan)
                sell_price.append(data['Close'][i])
                signal = -1
                macd_signal.append(signal)
            else:
                buy_price.append(np.nan)
                sell_price.append(np.nan)
                macd_signal.append(0)
        else:
            buy_price.append(np.nan)
            sell_price.append(np.nan)
            macd_signal.append(0)

    return buy_price, sell_price, macd_signal

buy_price, sell_price, macd_signal = implement_macd_strategy(data)
```

In [61]:

```
plt.figure(figsize=(25, 12.5))
plt.plot(data['Close'], color = 'skyblue', linewidth = 2, label = 'HDFCBANK')
plt.plot(data.index, buy_price, marker = '^', color = 'green', markersize = 10, label =
plt.plot(data.index, sell_price, marker = 'v', color = 'r', markersize = 10, label = 'SE
#plt.legend()
plt.title('HDFC BANK BUY SELL INDICATOR')

plt.legend(loc = 'lower right')
plt.show()

plt.figure(figsize=(50, 10))
plt.plot(data['MACD'], color = 'grey', linewidth = 0.5, label = 'MACD')
plt.plot(data['Signal'], color = 'skyblue', linewidth = 0.5, label = 'SIGNAL')

for i in range(len(data['Histogram'])):
    if str(data['Histogram'][i])[0] == '-':
        plt.bar(data['Close'].index[i], data['Histogram'][i], color = '#ef5350')
    else:
        plt.bar(data['Close'].index[i], data['Histogram'][i], color = '#26a69a')
plt.title('MACD SIGNALS')
plt.legend(loc = 'lower right')
plt.show()
```





In [62]:

```
position = []
for i in range(len(data['Signal'])):
    if macd_signal[i] > 1:
        position.append(0)
    else:
        position.append(1)

for i in range(len(data['Close'])):
    if macd_signal[i] == 1:
        position[i] = 1
    elif macd_signal[i] == -1:
        position[i] = 0
    else:
        position[i] = position[i-1]

macd = data['MACD']
signal = data['Signal']
close_price = data['Close']
macd_signal = pd.DataFrame(macd_signal).rename(columns = {0:'macd_signal'}).set_index(da
position = pd.DataFrame(position).rename(columns = {0:'macd_position'}).set_index(data.i

frames = [close_price, macd, signal, macd_signal, position]
strategy = pd.concat(frames, join = 'inner', axis = 1)

strategy
```

Out[62]:

```
                  Close       MACD     Signal  macd_signal  macd_position
      Date
2010-01-04   170.570007   0.000000   0.000000            0              1
2010-01-05   170.720001   0.003500   0.001925            1              1
2010-01-06   170.835007   0.008196   0.004446            0              1
2010-01-07   171.279999   0.026667   0.011767            0              1
2010-01-08   171.505005   0.045723   0.021515            0              1
       ...          ...        ...        ...          ...            ...
2019-12-24  1289.150024  24.181319  21.369321            0              1
2019-12-26  1270.449951  22.744403  21.619336            0              1
2019-12-27  1275.000000  21.815239  21.654954            0              1
2019-12-30  1282.150024  21.540525  21.634149           -1              0
2019-12-31  1272.099976  20.341850  21.399186            0              0

2462 rows × 5 columns
```

In [34]:

```
!pip install termcolor
```

```
Requirement already satisfied: termcolor in c:\users\user\anaconda3\lib\si
te-packages (2.3.0)
```

In [38]:

```
import math
from termcolor import colored as cl
```

In [63]:

```
HDFC_ret = pd.DataFrame(np.diff(data['Close'])).rename(columns = {0:'returns'})
macd_strategy_ret = []
for i in range(len(HDFC_ret)):
    try:
        returns = HDFC_ret['returns'][i]*strategy['macd_position'][i]
        macd_strategy_ret.append(returns)
    except:
        pass

macd_strategy_ret_df = pd.DataFrame(macd_strategy_ret).rename(columns = {0:'macd_returns

investment_value = 100000
number_of_stocks = math.floor(investment_value/data['Close'][0])
macd_investment_ret = []

for i in range(len(macd_strategy_ret_df['macd_returns'])):
    returns = number_of_stocks*macd_strategy_ret_df['macd_returns'][i]
    macd_investment_ret.append(returns)

macd_investment_ret_df = pd.DataFrame(macd_investment_ret).rename(columns = {0:'investme
total_investment_ret = round(sum(macd_investment_ret_df['investment_returns']), 2)
profit_percentage = math.floor((total_investment_ret/investment_value)*100)
print(cl('Profit gained from the MACD strategy by investing Rs 100k in NSE : {}'.format(
print(cl('Profit percentage of the MACD strategy : {}%'.format(profit_percentage), attrs
```

```
Profit gained from the MACD strategy by investing Rs 100k in NSE : 263313.
25
Profit percentage of the MACD strategy : 263%
```

In [64]:

```
returns=macd_investment_ret_df['investment_returns']/1000
cum_ret_c=0
cum_returns=[]
for i in range(len(HDFC_ret)):
    if (i==0):
        cum_returns.append(returns[0])
        cum_ret_c+=returns[0]
    else:
        cum_ret_c+=returns[i]
        cum_returns.append(cum_ret_c)
cum_returns_df=pd.DataFrame(cum_returns).rename(columns = {0:'cum_returns'})
print(cum_returns_df.iloc[-1])

volatility=returns.std()*np.sqrt(252)
print(volatility)

rolling_max=cum_returns_df.rolling(window=len(cum_returns_df), min_periods=1).max()
drawdown=(cum_returns_df/rolling_max)-1
max_drawdown=drawdown.min()
print(max_drawdown)

sharpe_ratio=(returns.mean()-(0.02/252))*np.sqrt(252)/returns.std()
print(sharpe_ratio)
```

```
cum_returns    263.313247
Name: 2460, dtype: float64
50.055564516391634
cum_returns   -11.700552
dtype: float64
0.5382536780464897
```

The MACD strategy with default settings gives around 47 percent volatility and the profit percentage comes out to be 163 per cent but with (15,50,10) setting gives 263 per cent profit with 3 per cent extra volatility.