```
print("Name : Bhagvat Nivrutti Mutthe ")
print("Roll No : BCB-76")
print("Assignment no.4")
print("RECURRENT NEURAL NETWORK (RNN)")
```

```
Name : Bhagvat Nivrutti Mutthe
Roll No : BCB-76
Assignment no.4
RECURRENT NEURAL NETWORK (RNN)
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
# read Dataset
df_train=pd.read_csv("Google_Stock_Price_Train.csv")
df_train.head(10)
```

| | Date | Open | High | Low | Close | Volume |
|---|---|---|---|---|---|---|
| 0 | 1/3/2012 | 325.25 | 332.83 | 324.97 | 663.59 | 7,380,500 |
| 1 | 1/4/2012 | 331.27 | 333.87 | 329.08 | 666.45 | 5,749,400 |
| 2 | 1/5/2012 | 329.83 | 330.75 | 326.89 | 657.21 | 6,590,300 |
| 3 | 1/6/2012 | 328.34 | 328.77 | 323.68 | 648.24 | 5,405,900 |
| 4 | 1/9/2012 | 322.04 | 322.29 | 309.46 | 620.76 | 11,688,800 |
| 5 | 1/10/2012 | 313.70 | 315.72 | 307.30 | 621.43 | 8,824,000 |
| 6 | 1/11/2012 | 310.59 | 313.52 | 309.40 | 624.25 | 4,817,800 |
| 7 | 1/12/2012 | 314.43 | 315.26 | 312.08 | 627.92 | 3,764,400 |
| 8 | 1/13/2012 | 311.96 | 312.30 | 309.37 | 623.28 | 4,631,800 |
| 9 | 1/17/2012 | 314.81 | 314.81 | 311.67 | 626.86 | 3,832,800 |

Next steps: Generate code with df_train View recommended plots

```
#keras only takes numpy array
#will use Open price for prediction so we need to make it NumPy array
training_set = df_train.iloc[:, 1: 2].values
training_set
```

```
array([[325.25],
       [331.27],
       [329.83],
       ...,
       [793.7 ],
       [783.33],
       [782.75]])
```

```
#scale the stock prices between (0, 1) to avoid intensive computation.
from sklearn.preprocessing import MinMaxScaler
sc= MinMaxScaler()
training_set=sc.fit_transform(training_set)
training_set
```

```
array([[0.08581368],
       [0.09701243],
       [0.09433366],
       ...,
       [0.95725128],
       [0.93796041],
       [0.93688146]])
```

```
x_train= training_set[0:1257]
y_train= training_set[1:1258]
display(x_train.shape, y_train.shape)
```

```
(1257, 1)
(1257, 1)
```

```
x_train=np.reshape(x_train, (1257 , 1 , 1))
```

```
x_train.shape
```

```
(1257, 1, 1)
```

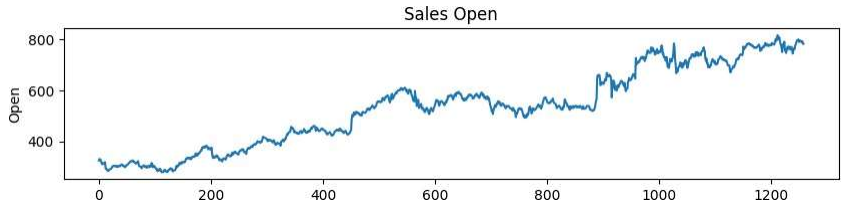
```
df_test=pd.read_csv("Google_Stock_Price_Test.csv")
df_test
```

| | Date | Open | High | Low | Close | Volume |
|---|---|---|---|---|---|---|
| 0 | 1/3/2017 | 778.81 | 789.63 | 775.80 | 786.14 | 1,657,300 |
| 1 | 1/4/2017 | 788.36 | 791.34 | 783.16 | 786.90 | 1,073,000 |
| 2 | 1/5/2017 | 786.08 | 794.48 | 785.02 | 794.02 | 1,335,200 |
| 3 | 1/6/2017 | 795.26 | 807.90 | 792.20 | 806.15 | 1,640,200 |
| 4 | 1/9/2017 | 806.40 | 809.97 | 802.83 | 806.65 | 1,272,400 |
| 5 | 1/10/2017 | 807.86 | 809.13 | 803.51 | 804.79 | 1,176,800 |
| 6 | 1/11/2017 | 805.00 | 808.15 | 801.37 | 807.91 | 1,065,900 |
| 7 | 1/12/2017 | 807.14 | 807.39 | 799.17 | 806.36 | 1,353,100 |
| 8 | 1/13/2017 | 807.48 | 811.22 | 806.69 | 807.88 | 1,099,200 |
| 9 | 1/17/2017 | 807.08 | 807.14 | 800.37 | 804.61 | 1,362,100 |
| 10 | 1/18/2017 | 805.81 | 806.21 | 800.99 | 806.07 | 1,294,400 |
| 11 | 1/19/2017 | 805.12 | 809.48 | 801.80 | 802.17 | 919,300 |
| 12 | 1/20/2017 | 806.91 | 806.91 | 801.69 | 805.02 | 1,670,000 |
| 13 | 1/23/2017 | 807.25 | 820.87 | 803.74 | 819.31 | 1,963,600 |
| 14 | 1/24/2017 | 822.30 | 825.90 | 817.82 | 823.87 | 1,474,000 |
| 15 | 1/25/2017 | 829.62 | 835.77 | 825.06 | 835.67 | 1,494,500 |
| 16 | 1/26/2017 | 837.81 | 838.00 | 827.01 | 832.15 | 2,973,900 |
| 17 | 1/27/2017 | 834.71 | 841.95 | 820.44 | 823.31 | 2,965,800 |
| 18 | 1/30/2017 | 814.66 | 815.84 | 799.80 | 802.32 | 3,246,600 |
| 19 | 1/31/2017 | 796.86 | 801.25 | 790.52 | 796.79 | 2,160,600 |

Next steps: Generate code with df_test View recommended plots

```
figure=plt.figure(figsize=(10,10))
plt.subplots_adjust(top=1.35, bottom=1.2)
df_train['Open'].plot()
plt.ylabel('Open')
plt.xlabel(None)
plt.title(f"Sales  Open")
```

```
Text(0.5, 1.0, 'Sales Open')
```




```
testing_set = df_test.iloc[:, 1: 2].values
testing_set
```

```
array([[778.81],
       [788.36],
       [786.08],
       [795.26],
       [806.4 ],
       [807.86],
       [805.  ],
       [807.14],
       [807.48],
       [807.08],
       [805.81],
       [805.12],
       [806.91],
       [807.25],
       [822.3 ],
       [829.62],
       [837.81],
       [834.71],
       [814.66],
       [796.86]])
```

```
testing_set=sc.fit_transform(testing_set)
testing_set.shape
```

```
(20, 1)
```

```
x_test=  testing_set[0:20]
y_test=  testing_set[0:20]
#display(x_test,  y_test)
y_test.shape
```

```
(20, 1)
```

```
x_test=np.reshape(x_test, (20 , 1 , 1))
```

```
x_test.shape
```

```
(20, 1, 1)
```

```
import tensorflow.keras as tk
```

```
model = tk.Sequential()

model.add(tk.layers.LSTM(units=5,  activation=  'sigmoid',  input_shape=  (None,1)))

model.add(tk.layers.Dense( units=1 ))

model.compile(optimizer='adam',  loss='mean_squared_error')
model.fit(x_train,  y_train,  batch_size=32,  epochs=50,validation_data=(x_test,y_test))
```

```
Epoch 1/50
40/40 [==============================] - 1s 7ms/step - loss: 0.1105 - val_loss: 0.0811
Epoch 2/50
40/40 [==============================] - 0s 2ms/step - loss: 0.0912 - val_loss: 0.0698
Epoch 3/50
40/40 [==============================] - 0s 2ms/step - loss: 0.0860 - val_loss: 0.0667
```

```
Epoch 4/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0839 - val_loss: 0.0651
Epoch 5/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0821 - val_loss: 0.0637
Epoch 6/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0802 - val_loss: 0.0622
Epoch 7/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0783 - val_loss: 0.0606
Epoch 8/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0764 - val_loss: 0.0591
Epoch 9/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0744 - val_loss: 0.0575
Epoch 10/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0724 - val_loss: 0.0559
Epoch 11/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0704 - val_loss: 0.0543
Epoch 12/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0683 - val_loss: 0.0525
Epoch 13/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0660 - val_loss: 0.0507
Epoch 14/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0637 - val_loss: 0.0488
Epoch 15/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0612 - val_loss: 0.0469
Epoch 16/50
40/40 [==============================]  - 0s 3ms/step - loss: 0.0588 - val_loss: 0.0449
Epoch 17/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0560 - val_loss: 0.0428
Epoch 18/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0533 - val_loss: 0.0405
Epoch 19/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0503 - val_loss: 0.0381
Epoch 20/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0473 - val_loss: 0.0358
Epoch 21/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0442 - val_loss: 0.0333
Epoch 22/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0410 - val_loss: 0.0308
Epoch 23/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0377 - val_loss: 0.0283
Epoch 24/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0346 - val_loss: 0.0258
Epoch 25/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0313 - val_loss: 0.0233
Epoch 26/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0282 - val_loss: 0.0209
Epoch 27/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0251 - val_loss: 0.0185
Epoch 28/50
40/40 [==============================]  - 0s 3ms/step - loss: 0.0222 - val_loss: 0.0163
Epoch 29/50
40/40 [==============================]  - 0s 2ms/step - loss: 0.0194 - val loss: 0.0141
```

```
y_pred=model.predict(x_test)
```

```
1/1 [==============================] - 0s 138ms/step
```

```
plt.plot( y_test , color = 'red' , label = 'Real Google Stock Price')
plt.plot( y_pred , color = 'blue' , label = 'Predicted Google Stock Price')
plt.title('Google Stock Price Prediction')
plt.xlabel( 'time' )
plt.ylabel( 'Google Stock Price' )
plt.legend()
plt.show()
```


Google Stock Price Prediction
Real Google Stock Price
Predicted Google Stock Price
Google Stock Price
1.0
0.8
0.6
0.4
0.2
0.0