In [1]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```python
training_set = pd.read_csv('C:\\Users\\dell\\Downloads\\Compressed\\P16-Recurrent-Neural-Networks\\Part 3 - Recurrent Neural Networks\\Google_Stock_Price_Train.csv')
```

In [3]:
```python
training_set = training_set.iloc[:, 1:2].values
training_set
```

Out[3]:
```
array([[325.25],
       [331.27],
       [329.83],
       ...,
       [793.7 ],
       [783.33],
       [782.75]])
```

In [4]:
```python
from sklearn.preprocessing import MinMaxScaler
```

In [5]:
```python
Sc = MinMaxScaler()
training_set = Sc.fit_transform(training_set)
```

In [6]:
```python
training_set
```

Out[6]:
```
array([[0.08581368],
       [0.09701243],
       [0.09433366],
       ...,
       [0.95725128],
       [0.93796041],
       [0.93688146]])
```

In [7]:
```python
X_train = training_set[0:1257]
y_train = training_set[1:1258]
```

In [8]:
```python
X_train = np.reshape(X_train, (1257, 1, 1))
X_train
```

Out[8]:
```
array([[[0.08581368]],

       [[0.09701243]],

       [[0.09433366]],

       ...,

       [[0.95163331]],

       [[0.95725128]],

       [[0.93796041]]])
```

In [9]:
```python
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
```

In [10]:
```python
classifier = Sequential()
```

In [11]:
```python
classifier.add(LSTM(units = 4, activation = 'sigmoid',input_shape = (None, 1)))
classifier.add(Dense(units = 1))
classifier.compile(optimizer='adam',loss = 'mean_squared_error')
classifier.fit(X_train,y_train,batch_size=32,epochs = 200)
```

```
Epoch 1/200
40/40 [==============================] - 1s 955us/step - loss: 0.9898
Epoch 2/200
40/40 [==============================] - 0s 937us/step - loss: 0.8142
Epoch 3/200
40/40 [==============================] - 0s 936us/step - loss: 0.6677
Epoch 4/200
40/40 [==============================] - 0s 973us/step - loss: 0.5455
Epoch 5/200
40/40 [==============================] - 0s 978us/step - loss: 0.4442
Epoch 6/200
40/40 [==============================] - 0s 994us/step - loss: 0.3612
Epoch 7/200
40/40 [==============================] - 0s 984us/step - loss: 0.2934
Epoch 8/200
40/40 [==============================] - 0s 940us/step - loss: 0.2386
Epoch 9/200
40/40 [==============================] - 0s 989us/step - loss: 0.1948
Epoch 10/200
40/40 [==============================] - 0s 946us/step - loss: 0.1604
Epoch 11/200
40/40 [==============================] - 0s 1ms/step - loss: 0.1338
Epoch 12/200
40/40 [==============================] - 0s 970us/step - loss: 0.1136
Epoch 13/200
40/40 [==============================] - 0s 965us/step - loss: 0.0984
Epoch 14/200
40/40 [==============================] - 0s 964us/step - loss: 0.0873
Epoch 15/200
40/40 [==============================] - 0s 922us/step - loss: 0.0793
Epoch 16/200
40/40 [==============================] - 0s 962us/step - loss: 0.0735
Epoch 17/200
40/40 [==============================] - 0s 957us/step - loss: 0.0695
Epoch 18/200
40/40 [==============================] - 0s 949us/step - loss: 0.0667
Epoch 19/200
40/40 [==============================] - 0s 969us/step - loss: 0.0646
Epoch 20/200
40/40 [==============================] - 0s 936us/step - loss: 0.0632
Epoch 21/200
40/40 [==============================] - 0s 945us/step - loss: 0.0622
Epoch 22/200
40/40 [==============================] - 0s 951us/step - loss: 0.0613
Epoch 23/200
40/40 [==============================] - 0s 906us/step - loss: 0.0606
Epoch 24/200
40/40 [==============================] - 0s 956us/step - loss: 0.0600
Epoch 25/200
40/40 [==============================] - 0s 937us/step - loss: 0.0594
Epoch 26/200
40/40 [==============================] - 0s 958us/step - loss: 0.0589
Epoch 27/200
40/40 [==============================] - 0s 974us/step - loss: 0.0583
Epoch 28/200
40/40 [==============================] - 0s 924us/step - loss: 0.0578
Epoch 29/200
40/40 [==============================] - 0s 944us/step - loss: 0.0572
Epoch 30/200
40/40 [==============================] - 0s 932us/step - loss: 0.0566
Epoch 31/200
40/40 [==============================] - 0s 946us/step - loss: 0.0560
Epoch 32/200
40/40 [==============================] - 0s 954us/step - loss: 0.0554
Epoch 33/200
40/40 [==============================] - 0s 946us/step - loss: 0.0548
Epoch 34/200
40/40 [==============================] - 0s 947us/step - loss: 0.0541
Epoch 35/200
40/40 [==============================] - 0s 928us/step - loss: 0.0535
Epoch 36/200
40/40 [==============================] - 0s 953us/step - loss: 0.0528
Epoch 37/200
40/40 [==============================] - 0s 949us/step - loss: 0.0521
Epoch 38/200
40/40 [==============================] - 0s 942us/step - loss: 0.0514
Epoch 39/200
40/40 [==============================] - 0s 934us/step - loss: 0.0507
Epoch 40/200
40/40 [==============================] - 0s 934us/step - loss: 0.0500
Epoch 41/200
40/40 [==============================] - 0s 901us/step - loss: 0.0492
Epoch 42/200
40/40 [==============================] - 0s 984us/step - loss: 0.0484
Epoch 43/200
40/40 [==============================] - 0s 979us/step - loss: 0.0476
Epoch 44/200
40/40 [==============================] - 0s 989us/step - loss: 0.0468
Epoch 45/200
40/40 [==============================] - 0s 942us/step - loss: 0.0460
Epoch 46/200
40/40 [==============================] - 0s 960us/step - loss: 0.0451
Epoch 47/200
40/40 [==============================] - 0s 955us/step - loss: 0.0442
Epoch 48/200
40/40 [==============================] - 0s 975us/step - loss: 0.0433
Epoch 49/200
40/40 [==============================] - 0s 1ms/step - loss: 0.0424
Epoch 50/200
40/40 [==============================] - 0s 974us/step - loss: 0.0415
Epoch 51/200
40/40 [==============================] - 0s 985us/step - loss: 0.0405
Epoch 52/200
40/40 [==============================] - 0s 1ms/step - loss: 0.0395
Epoch 53/200
40/40 [==============================] - 0s 995us/step - loss: 0.0385
Epoch 54/200
40/40 [==============================] - 0s 937us/step - loss: 0.0375
Epoch 55/200
40/40 [==============================] - 0s 940us/step - loss: 0.0365
Epoch 56/200
40/40 [==============================] - 0s 906us/step - loss: 0.0354
Epoch 57/200
40/40 [==============================] - 0s 919us/step - loss: 0.0344
Epoch 58/200
40/40 [==============================] - 0s 946us/step - loss: 0.0333
Epoch 59/200
40/40 [==============================] - 0s 900us/step - loss: 0.0322
Epoch 60/200
40/40 [==============================] - 0s 975us/step - loss: 0.0311
Epoch 61/200
40/40 [==============================] - 0s 934us/step - loss: 0.0300
Epoch 62/200
40/40 [==============================] - 0s 970us/step - loss: 0.0288
Epoch 63/200
40/40 [==============================] - 0s 962us/step - loss: 0.0277
Epoch 64/200
40/40 [==============================] - 0s 946us/step - loss: 0.0266
Epoch 65/200
40/40 [==============================] - 0s 929us/step - loss: 0.0255
Epoch 66/200
40/40 [==============================] - 0s 946us/step - loss: 0.0243
Epoch 67/200
40/40 [==============================] - 0s 949us/step - loss: 0.0232
Epoch 68/200
40/40 [==============================] - 0s 938us/step - loss: 0.0220
Epoch 69/200
40/40 [==============================] - 0s 960us/step - loss: 0.0209
Epoch 70/200
40/40 [==============================] - 0s 928us/step - loss: 0.0198
Epoch 71/200
40/40 [==============================] - 0s 981us/step - loss: 0.0187
Epoch 72/200
40/40 [==============================] - 0s 945us/step - loss: 0.0176
Epoch 73/200
40/40 [==============================] - 0s 989us/step - loss: 0.0165
Epoch 74/200
40/40 [==============================] - 0s 969us/step - loss: 0.0155
Epoch 75/200
40/40 [==============================] - 0s 951us/step - loss: 0.0145
Epoch 76/200
40/40 [==============================] - 0s 981us/step - loss: 0.0135
Epoch 77/200
40/40 [==============================] - 0s 921us/step - loss: 0.0126
Epoch 78/200
40/40 [==============================] - 0s 963us/step - loss: 0.0116
Epoch 79/200
40/40 [==============================] - 0s 982us/step - loss: 0.0108
Epoch 80/200
40/40 [==============================] - 0s 959us/step - loss: 0.0099
Epoch 81/200
40/40 [==============================] - 0s 949us/step - loss: 0.0091
Epoch 82/200
40/40 [==============================] - 0s 950us/step - loss: 0.0084
Epoch 83/200
40/40 [==============================] - 0s 985us/step - loss: 0.0077
Epoch 84/200
40/40 [==============================] - 0s 943us/step - loss: 0.0070
Epoch 85/200
40/40 [==============================] - 0s 942us/step - loss: 0.0063
Epoch 86/200
40/40 [==============================] - 0s 926us/step - loss: 0.0058
Epoch 87/200
40/40 [==============================] - 0s 943us/step - loss: 0.0052
Epoch 88/200
40/40 [==============================] - 0s 946us/step - loss: 0.0047
Epoch 89/200
40/40 [==============================] - 0s 975us/step - loss: 0.0042
Epoch 90/200
40/40 [==============================] - 0s 929us/step - loss: 0.0038
Epoch 91/200
40/40 [==============================] - 0s 981us/step - loss: 0.0034
Epoch 92/200
40/40 [==============================] - 0s 955us/step - loss: 0.0031
Epoch 93/200
40/40 [==============================] - 0s 955us/step - loss: 0.0028
Epoch 94/200
40/40 [==============================] - 0s 951us/step - loss: 0.0025
Epoch 95/200
40/40 [==============================] - 0s 936us/step - loss: 0.0022
Epoch 96/200
40/40 [==============================] - 0s 957us/step - loss: 0.0020
Epoch 97/200
40/40 [==============================] - 0s 905us/step - loss: 0.0018
Epoch 98/200
40/40 [==============================] - 0s 918us/step - loss: 0.0017
Epoch 99/200
40/40 [==============================] - 0s 973us/step - loss: 0.0015
Epoch 100/200
40/40 [==============================] - 0s 873us/step - loss: 0.0014
Epoch 101/200
40/40 [==============================] - 0s 936us/step - loss: 0.0013
Epoch 102/200
40/40 [==============================] - 0s 912us/step - loss: 0.0012
Epoch 103/200
40/40 [==============================] - 0s 940us/step - loss: 0.0011
Epoch 104/200
40/40 [==============================] - 0s 929us/step - loss: 0.0010
Epoch 105/200
40/40 [==============================] - 0s 909us/step - loss: 9.6051e-04
Epoch 106/200
40/40 [==============================] - 0s 898us/step - loss: 9.1051e-04
Epoch 107/200
40/40 [==============================] - 0s 888us/step - loss: 8.6640e-04
Epoch 108/200
40/40 [==============================] - 0s 945us/step - loss: 8.3097e-04
Epoch 109/200
40/40 [==============================] - 0s 945us/step - loss: 8.0070e-04
Epoch 110/200
40/40 [==============================] - 0s 946us/step - loss: 7.7189e-04
Epoch 111/200
40/40 [==============================] - 0s 957us/step - loss: 7.4909e-04
Epoch 112/200
40/40 [==============================] - 0s 947us/step - loss: 7.3230e-04
Epoch 113/200
40/40 [==============================] - 0s 940us/step - loss: 7.1212e-04
Epoch 114/200
40/40 [==============================] - 0s 997us/step - loss: 6.9712e-04
Epoch 115/200
40/40 [==============================] - 0s 958us/step - loss: 6.8563e-04
Epoch 116/200
40/40 [==============================] - 0s 961us/step - loss: 6.7277e-04
Epoch 117/200
40/40 [==============================] - 0s 978us/step - loss: 6.6128e-04
Epoch 118/200
40/40 [==============================] - 0s 972us/step - loss: 6.5163e-04
Epoch 119/200
40/40 [==============================] - 0s 940us/step - loss: 6.4167e-04
Epoch 120/200
40/40 [==============================] - 0s 945us/step - loss: 6.3365e-04
Epoch 121/200
40/40 [==============================] - 0s 994us/step - loss: 6.2546e-04
Epoch 122/200
40/40 [==============================] - 0s 958us/step - loss: 6.1658e-04
Epoch 123/200
40/40 [==============================] - 0s 957us/step - loss: 6.0934e-04
Epoch 124/200
40/40 [==============================] - 0s 1ms/step - loss: 6.0354e-04
Epoch 125/200
40/40 [==============================] - 0s 979us/step - loss: 5.9440e-04
Epoch 126/200
40/40 [==============================] - 0s 963us/step - loss: 5.8762e-04
Epoch 127/200
40/40 [==============================] - 0s 979us/step - loss: 5.7949e-04
Epoch 128/200
40/40 [==============================] - 0s 936us/step - loss: 5.7324e-04
Epoch 129/200
40/40 [==============================] - 0s 931us/step - loss: 5.6572e-04
Epoch 130/200
40/40 [==============================] - 0s 923us/step - loss: 5.5880e-04
Epoch 131/200
40/40 [==============================] - 0s 948us/step - loss: 5.5117e-04
Epoch 132/200
40/40 [==============================] - 0s 926us/step - loss: 5.4502e-04
Epoch 133/200
40/40 [==============================] - 0s 902us/step - loss: 5.3887e-04
Epoch 134/200
40/40 [==============================] - 0s 945us/step - loss: 5.3294e-04
Epoch 135/200
40/40 [==============================] - 0s 940us/step - loss: 5.2579e-04
Epoch 136/200
40/40 [==============================] - 0s 947us/step - loss: 5.1979e-04
Epoch 137/200
40/40 [==============================] - 0s 937us/step - loss: 5.1173e-04
Epoch 138/200
40/40 [==============================] - 0s 930us/step - loss: 5.0533e-04
Epoch 139/200
40/40 [==============================] - 0s 927us/step - loss: 4.9921e-04
Epoch 140/200
40/40 [==============================] - 0s 963us/step - loss: 4.9263e-04
Epoch 141/200
40/40 [==============================] - 0s 929us/step - loss: 4.8735e-04
Epoch 142/200
40/40 [==============================] - 0s 941us/step - loss: 4.8059e-04
Epoch 143/200
40/40 [==============================] - 0s 976us/step - loss: 4.7435e-04
Epoch 144/200
40/40 [==============================] - 0s 892us/step - loss: 4.6843e-04
Epoch 145/200
40/40 [==============================] - 0s 990us/step - loss: 4.6295e-04
Epoch 146/200
40/40 [==============================] - 0s 915us/step - loss: 4.5718e-04
Epoch 147/200
40/40 [==============================] - 0s 941us/step - loss: 4.5127e-04
Epoch 148/200
40/40 [==============================] - 0s 945us/step - loss: 4.4614e-04
Epoch 149/200
40/40 [==============================] - 0s 983us/step - loss: 4.4088e-04
Epoch 150/200
40/40 [==============================] - 0s 903us/step - loss: 4.3521e-04
Epoch 151/200
40/40 [==============================] - 0s 924us/step - loss: 4.2995e-04
Epoch 152/200
40/40 [==============================] - 0s 950us/step - loss: 4.2522e-04
Epoch 153/200
40/40 [==============================] - 0s 942us/step - loss: 4.2181e-04
Epoch 154/200
40/40 [==============================] - 0s 959us/step - loss: 4.1556e-04
Epoch 155/200
40/40 [==============================] - 0s 931us/step - loss: 4.1028e-04
Epoch 156/200
40/40 [==============================] - 0s 923us/step - loss: 4.0622e-04
Epoch 157/200
40/40 [==============================] - 0s 924us/step - loss: 4.0064e-04
Epoch 158/200
40/40 [==============================] - 0s 952us/step - loss: 3.9799e-04
Epoch 159/200
40/40 [==============================] - 0s 947us/step - loss: 3.9217e-04
Epoch 160/200
40/40 [==============================] - 0s 959us/step - loss: 3.8846e-04
Epoch 161/200
40/40 [==============================] - 0s 908us/step - loss: 3.8280e-04
Epoch 162/200
40/40 [==============================] - 0s 905us/step - loss: 3.8170e-04
Epoch 163/200
40/40 [==============================] - 0s 942us/step - loss: 3.7633e-04
Epoch 164/200
40/40 [==============================] - 0s 907us/step - loss: 3.7178e-04
Epoch 165/200
40/40 [==============================] - 0s 925us/step - loss: 3.6865e-04
Epoch 166/200
40/40 [==============================] - 0s 886us/step - loss: 3.6404e-04
Epoch 167/200
40/40 [==============================] - 0s 949us/step - loss: 3.6113e-04
Epoch 168/200
40/40 [==============================] - 0s 958us/step - loss: 3.5794e-04
Epoch 169/200
40/40 [==============================] - 0s 938us/step - loss: 3.5412e-04
Epoch 170/200
40/40 [==============================] - 0s 965us/step - loss: 3.5005e-04
Epoch 171/200
40/40 [==============================] - 0s 964us/step - loss: 3.4657e-04
Epoch 172/200
40/40 [==============================] - 0s 979us/step - loss: 3.4363e-04
Epoch 173/200
40/40 [==============================] - 0s 1ms/step - loss: 3.4029e-04
Epoch 174/200
40/40 [==============================] - 0s 960us/step - loss: 3.3859e-04
Epoch 175/200
40/40 [==============================] - 0s 938us/step - loss: 3.3560e-04
Epoch 176/200
40/40 [==============================] - 0s 933us/step - loss: 3.3218e-04
Epoch 177/200
40/40 [==============================] - 0s 922us/step - loss: 3.2940e-04
Epoch 178/200
40/40 [==============================] - 0s 1ms/step - loss: 3.2711e-04
Epoch 179/200
40/40 [==============================] - 0s 950us/step - loss: 3.2441e-04
Epoch 180/200
40/40 [==============================] - 0s 932us/step - loss: 3.2207e-04
Epoch 181/200
40/40 [==============================] - 0s 934us/step - loss: 3.1962e-04
Epoch 182/200
40/40 [==============================] - 0s 940us/step - loss: 3.1646e-04
Epoch 183/200
40/40 [==============================] - 0s 971us/step - loss: 3.1625e-04
Epoch 184/200
40/40 [==============================] - 0s 945us/step - loss: 3.1245e-04
Epoch 185/200
40/40 [==============================] - 0s 965us/step - loss: 3.0982e-04
Epoch 186/200
40/40 [==============================] - 0s 955us/step - loss: 3.0798e-04
Epoch 187/200
40/40 [==============================] - 0s 988us/step - loss: 3.0567e-04
Epoch 188/200
40/40 [==============================] - 0s 960us/step - loss: 3.0432e-04
Epoch 189/200
40/40 [==============================] - 0s 947us/step - loss: 3.0283e-04
Epoch 190/200
40/40 [==============================] - 0s 994us/step - loss: 3.0003e-04
Epoch 191/200
40/40 [==============================] - 0s 941us/step - loss: 2.9906e-04
Epoch 192/200
40/40 [==============================] - 0s 980us/step - loss: 2.9808e-04
Epoch 193/200
40/40 [==============================] - 0s 981us/step - loss: 2.9492e-04
Epoch 194/200
40/40 [==============================] - 0s 963us/step - loss: 2.9465e-04
Epoch 195/200
40/40 [==============================] - 0s 976us/step - loss: 2.9486e-04
Epoch 196/200
40/40 [==============================] - 0s 977us/step - loss: 2.9037e-04
Epoch 197/200
40/40 [==============================] - 0s 982us/step - loss: 2.9319e-04
Epoch 198/200
40/40 [==============================] - 0s 939us/step - loss: 2.8745e-04
Epoch 199/200
40/40 [==============================] - 0s 938us/step - loss: 2.8633e-04
Epoch 200/200
40/40 [==============================] - 0s 955us/step - loss: 2.8628e-04
```

Out[11]:
```
<keras.callbacks.History at 0x2791cb92c70>
```

In [12]:
```python
test_set = pd.read_csv('C:\\Users\\dell\\Downloads\\Compressed\\P16-Recurrent-Neural-Networks\\Part 3 - Recurrent Neural Networks\\Google_Stock_Price_Test.csv')
```

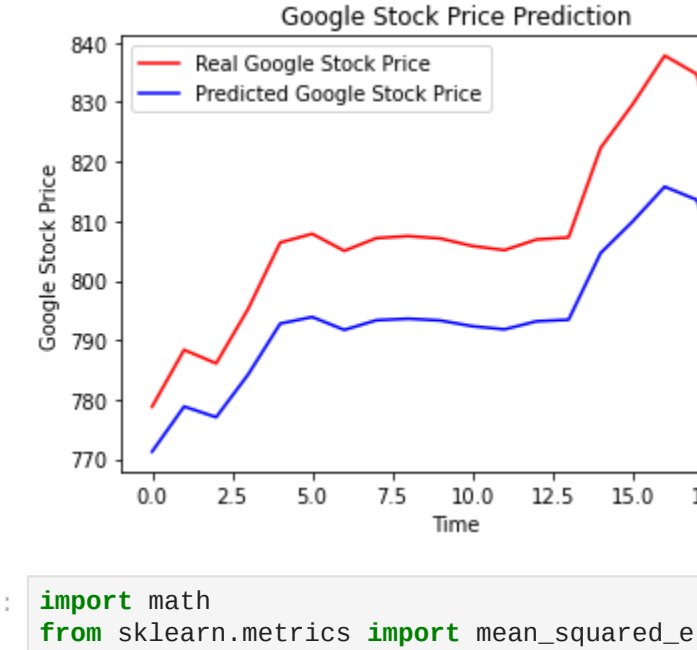
In [13]:
```python
real_stock_price = test_set.iloc[:, 1:2].values
real_stock_price
```

Out[13]:
```
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]])
```

In [14]:
```python
inputs = real_stock_price
inputs = Sc.transform(inputs)
```

In [15]:
```python
inputs = np.reshape(inputs, (20, 1, 1))
predicted_stock_price = classifier.predict(inputs)
predicted_stock_price = Sc.inverse_transform(predicted_stock_price)
```

In [16]:
```python
plt.plot(real_stock_price,color = 'red',label = 'Real Google Stock Price')
plt.plot(predicted_stock_price, 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()
```



In [17]:
```python
import math
from sklearn.metrics import mean_squared_error
```

In [18]:
```python
res = math.sqrt(mean_squared_error(real_stock_price, predicted_stock_price ))
res/800
```

Out[18]:
```
0.018175908258009875
```

In [ ]: