IMPORT LIBRARIES AND DATASET

In [153]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from jupyterthemes import jtplot
jtplot.style(theme = 'monokai', context = 'notebook', ticks = True, grid = False)
```

In [154]:
```
# Read the csv file
admission_df = pd.read_csv('Admission_Predict.csv')
admission_df.head()
```

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

In [155]:
```
# Drop Serial No. column
admission_df.drop('Serial No.', axis = 1, inplace = True)
```

In [156]:
```
admission_df
```

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65
...	...	...	...	...	...	...	...	...
495	332	108	5	4.5	4.0	9.02	1	0.87
496	337	117	5	5.0	5.0	9.87	1	0.96
497	330	120	5	4.5	5.0	9.56	1	0.93
498	312	103	4	4.0	5.0	8.43	0	0.73
499	327	113	4	4.5	4.5	9.04	0	0.84

500 rows × 8 columns

PERFORM EXPLORATORY DATA ANALYSIS

In [157]:
```
# Check for null values
admission_df.isnull().sum()
```

```
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
dtype: int64
```

In [158]:
```
# Check for dataframe information
admission_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   GRE Score          500 non-null    int64
 1   TOEFL Score        500 non-null    int64
 2   University Rating  500 non-null    int64
 3   SOP                500 non-null    float64
 4   LOR                500 non-null    float64
 5   CGPA               500 non-null    float64
 6   Research           500 non-null    int64
 7   Chance of Admit    500 non-null    float64
dtypes: float64(4), int64(4)
memory usage: 31.4 KB
```

In [159]:
```
# Statistical summary of the dataframe
admission_df.describe()
```

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
count	500.000000	500.000000	500.000000	500.000000	500.00000	500.000000	500.000000	500.00000
mean	316.472000	107.192000	3.114000	3.374000	3.48400	8.576440	0.560000	0.72174
std	11.295148	6.081868	1.143512	0.991004	0.92545	0.604813	0.496884	0.14114
min	290.000000	92.000000	1.000000	1.000000	1.00000	6.800000	0.000000	0.34000
25%	308.000000	103.000000	2.000000	2.500000	3.00000	8.127500	0.000000	0.63000
50%	317.000000	107.000000	3.000000	3.500000	3.50000	8.560000	1.000000	0.72000
75%	325.000000	112.000000	4.000000	4.000000	4.00000	9.040000	1.000000	0.82000
max	340.000000	120.000000	5.000000	5.000000	5.00000	9.920000	1.000000	0.97000

In [160]:
```
# Grouping by university ranking
df_university = admission_df.groupby(by = 'University Rating').mean()
df_university
```

University Rating	GRE Score	TOEFL Score	SOP	LOR	CGPA	Research	Chance of Admit
1	304.911765	100.205882	1.941176	2.426471	7.798529	0.294118	0.562059
2	309.134921	103.444444	2.682540	2.956349	8.177778	0.293651	0.626111
3	315.030864	106.314815	3.308642	3.401235	8.500123	0.537037	0.702901
4	323.304762	110.961905	4.000000	3.947619	8.936667	0.780952	0.801619
5	327.890411	113.438356	4.479452	4.404110	9.278082	0.876712	0.888082

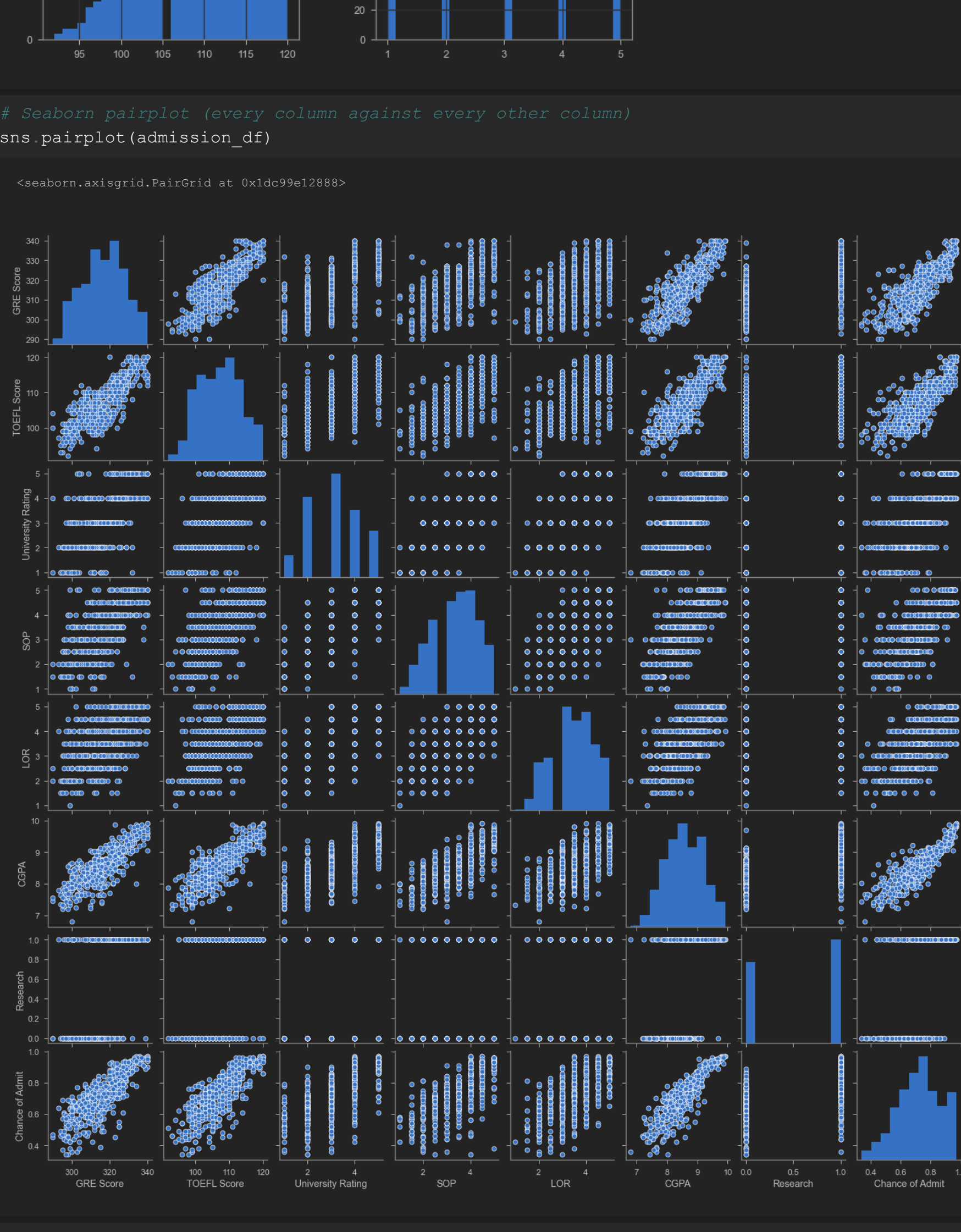
PERFORM DATA VISUALIZATION

In [161]:
```
# Histogram of every column
admission_df.hist(bins = 30, figsize = (20, 20))
```

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001DC9906FE48>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC991A6588>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC990B3248>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001DC990E5A08>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC9911B608>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC991B9FC8>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001DC991F1C08>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC992275C8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DC992276C8>]],
      dtype=object)
```

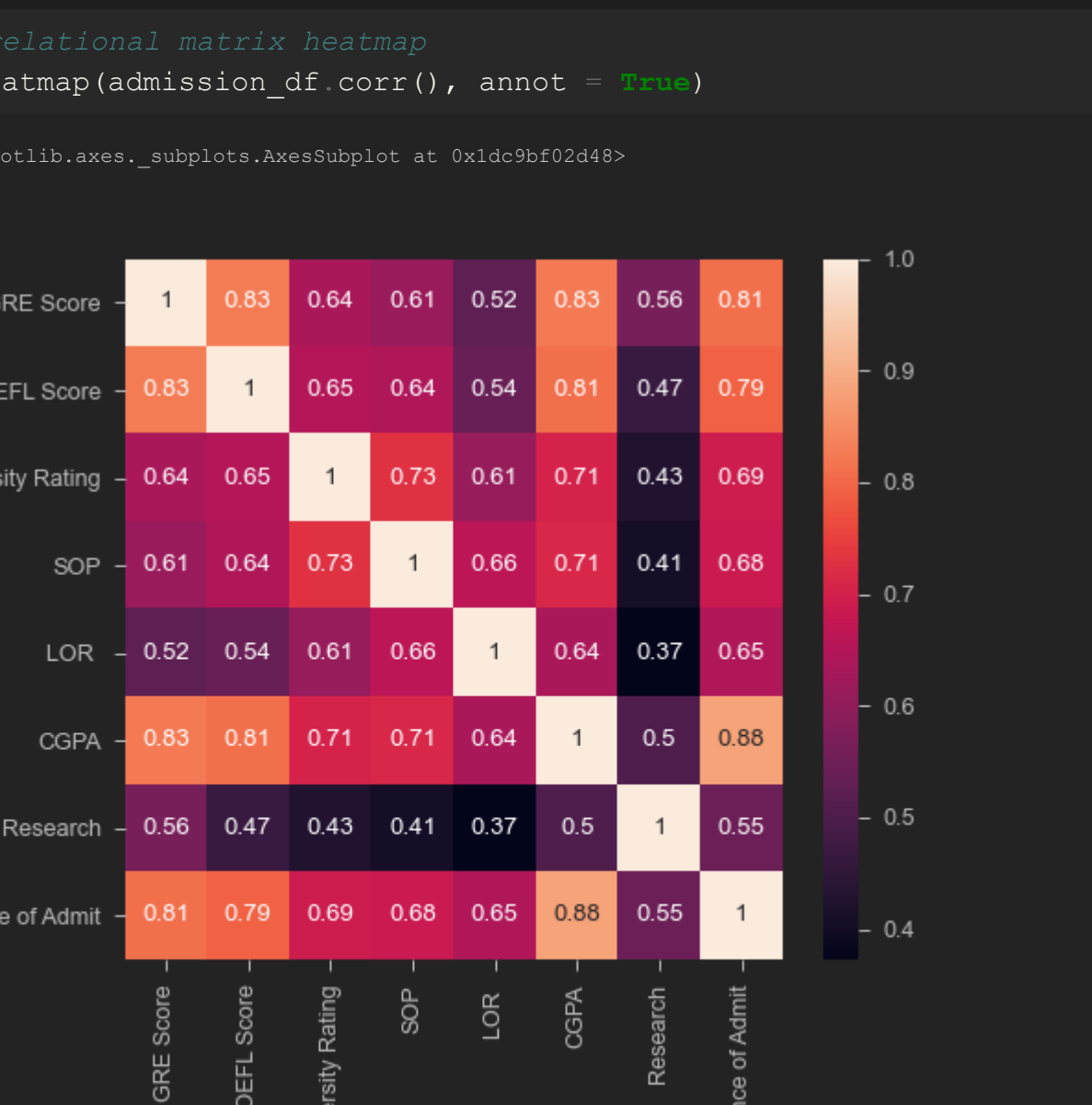
In [162]:
```
# Seaborn pairplot (every column against every other column)
sns.pairplot(admission_df)
```

```
<seaborn.axisgrid.PairGrid at 0x1dc99e12888>
```



In [163]:
```
# Co-relational matrix heatmap
sns.heatmap(admission_df.corr(), annot = True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x1dc9bf02d48>
```



TRAINING AND TESTING DATASET

In [164]:
```
# Check columns
admission_df.columns
```

```
Index(['GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'LOR ', 'CGPA',
       'Research', 'Chance of Admit'],
      dtype='object')
```

In [165]:
```
# Differentiate independent and dependent variables
x = admission_df.drop('Chance of Admit', axis = 1)
y = admission_df[['Chance of Admit']]
```

In [166]:
```
# check for dimentions
y.shape
```

```
(500, 1)
```

In [167]:
```
# Create/Convert to NumPy Array
x = np.array(x)
y = np.array(y)
```

In [168]:
```
# scale my data (remove partiality)
from sklearn.preprocessing import StandardScaler
scaler_x = StandardScaler()
scaler_y = StandardScaler()

x = scaler_x.fit_transform(x)
y = scaler_y.fit_transform(y)
```

In [169]:
```
# Splitting the data into testing and training set
from sklearn.model_selection import train_test_split

x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.15)
```

TRAIN AND EVALUATE LINEAR REGRESSION MODEL

In [170]:
```
# Import libraries
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, accuracy_score
```

In [171]:
```
# Train regression model
LinearRegression_model = LinearRegression()
LinearRegression_model.fit(x_train, y_train)
```

```
LinearRegression()
```

In [172]:
```
# Check accuracy of regression model
accuracy_LinearRegression = LinearRegression_model.score(x_test, y_test)
accuracy_LinearRegression
```

```
0.8171136993579111
```

TRAINING AND EVALUATE AN ARTIFICIAL NEURAL NETWORK

In [173]:
```
# Import libraries
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.layers import Dense, Activation, Dropout
from tensorflow.keras.optimizers import Adam
```

In [174]:
```
# Building Artificial Neural Network
ANN_model = keras.Sequential()
ANN_model.add(Dense(50, input_dim = 7))
ANN_model.add(Activation('relu'))
ANN_model.add(Dense(150))
ANN_model.add(Activation('relu'))
ANN_model.add(Dropout(0.5))
ANN_model.add(Dense(150))
ANN_model.add(Activation('relu'))
ANN_model.add(Dropout(0.5))
ANN_model.add(Dense(50))
ANN_model.add(Activation('linear'))
ANN_model.add(Dense(1))
ANN_model.compile(loss = 'mse', optimizer = 'adam')
ANN_model.summary()
```

```
Model: "sequential_3"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_11 (Dense)             (None, 50)                400
_________________________________________________________________
activation_8 (Activation)    (None, 50)                0
_________________________________________________________________
dense_12 (Dense)             (None, 150)               7650
_________________________________________________________________
activation_9 (Activation)    (None, 150)               0
_________________________________________________________________
dropout_4 (Dropout)          (None, 150)               0
_________________________________________________________________
dense_13 (Dense)             (None, 150)               22650
_________________________________________________________________
activation_10 (Activation)   (None, 150)               0
_________________________________________________________________
dropout_5 (Dropout)          (None, 150)               0
_________________________________________________________________
dense_14 (Dense)             (None, 50)                7550
_________________________________________________________________
activation_11 (Activation)   (None, 50)                0
_________________________________________________________________
dense_15 (Dense)             (None, 1)                 51
=================================================================
Total params: 38,301
Trainable params: 38,301
Non-trainable params: 0
_________________________________________________________________
```

In [175]:
```
# Compile the model
ANN_model.compile(optimizer = 'Adam', loss = 'mean_squared_error')
```

In [176]:
```
# Train the network
epochs_hist = ANN_model.fit(x_train, y_train, epochs = 100, batch_size = 20, validation_split = 0.2)
```

```
Epoch 1/100
17/17 [==============================] - 0s 13ms/step - loss: 0.5725 - val_loss: 0.2288
Epoch 2/100
17/17 [==============================] - 0s 5ms/step - loss: 0.3473 - val_loss: 0.2469
Epoch 3/100
17/17 [==============================] - 0s 4ms/step - loss: 0.3283 - val_loss: 0.2104
Epoch 4/100
17/17 [==============================] - 0s 4ms/step - loss: 0.3268 - val_loss: 0.2159
Epoch 5/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2742 - val_loss: 0.1718
Epoch 6/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2715 - val_loss: 0.1843
Epoch 7/100
17/17 [==============================] - 0s 5ms/step - loss: 0.2660 - val_loss: 0.1922
Epoch 8/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2455 - val_loss: 0.1836
Epoch 9/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2230 - val_loss: 0.1846
Epoch 10/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2264 - val_loss: 0.2047
Epoch 11/100
17/17 [==============================] - 0s 3ms/step - loss: 0.2416 - val_loss: 0.1724
Epoch 12/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2369 - val_loss: 0.2022
Epoch 13/100
17/17 [==============================] - 0s 3ms/step - loss: 0.2420 - val_loss: 0.2074
Epoch 14/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2155 - val_loss: 0.1760
Epoch 15/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2132 - val_loss: 0.1952
Epoch 16/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2277 - val_loss: 0.2118
Epoch 17/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2081 - val_loss: 0.1707
Epoch 18/100
17/17 [==============================] - 0s 3ms/step - loss: 0.2126 - val_loss: 0.2327
Epoch 19/100
17/17 [==============================] - 0s 3ms/step - loss: 0.2272 - val_loss: 0.1904
Epoch 20/100
17/17 [==============================] - 0s 3ms/step - loss: 0.2003 - val_loss: 0.1965
Epoch 21/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1934 - val_loss: 0.1771
Epoch 22/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1932 - val_loss: 0.2062
Epoch 23/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1908 - val_loss: 0.1957
Epoch 24/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1802 - val_loss: 0.2065
Epoch 25/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1938 - val_loss: 0.1965
Epoch 26/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1866 - val_loss: 0.1983
Epoch 27/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2000 - val_loss: 0.1829
Epoch 28/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1813 - val_loss: 0.1927
Epoch 29/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1744 - val_loss: 0.2226
Epoch 30/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1831 - val_loss: 0.1988
Epoch 31/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1800 - val_loss: 0.1986
Epoch 32/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1822 - val_loss: 0.1929
Epoch 33/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1959 - val_loss: 0.2022
Epoch 34/100
17/17 [==============================] - 0s 4ms/step - loss: 0.2015 - val_loss: 0.1852
Epoch 35/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1685 - val_loss: 0.1945
Epoch 36/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1802 - val_loss: 0.1766
Epoch 37/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1768 - val_loss: 0.2198
Epoch 38/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1764 - val_loss: 0.2023
Epoch 39/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1816 - val_loss: 0.1765
Epoch 40/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1588 - val_loss: 0.1862
Epoch 41/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1603 - val_loss: 0.1864
Epoch 42/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1658 - val_loss: 0.1757
Epoch 43/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1570 - val_loss: 0.2277
Epoch 44/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1606 - val_loss: 0.1938
Epoch 45/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1534 - val_loss: 0.1789
Epoch 46/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1752 - val_loss: 0.2164
Epoch 47/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1584 - val_loss: 0.1873
Epoch 48/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1690 - val_loss: 0.1849
Epoch 49/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1545 - val_loss: 0.1915
Epoch 50/100
17/17 [==============================] - 0s 5ms/step - loss: 0.1636 - val_loss: 0.2357
Epoch 51/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1701 - val_loss: 0.2375
Epoch 52/100
17/17 [==============================] - 0s 5ms/step - loss: 0.1542 - val_loss: 0.1989
Epoch 53/100
17/17 [==============================] - 0s 5ms/step - loss: 0.1488 - val_loss: 0.1945
Epoch 54/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1378 - val_loss: 0.1856
Epoch 55/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1372 - val_loss: 0.1805
Epoch 56/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1328 - val_loss: 0.1936
Epoch 57/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1368 - val_loss: 0.1979
Epoch 58/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1414 - val_loss: 0.2122
Epoch 59/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1440 - val_loss: 0.1897
Epoch 60/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1448 - val_loss: 0.1889
Epoch 61/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1435 - val_loss: 0.1967
Epoch 62/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1207 - val_loss: 0.1973
Epoch 63/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1252 - val_loss: 0.1994
Epoch 64/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1425 - val_loss: 0.2158
Epoch 65/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1315 - val_loss: 0.1971
Epoch 66/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1340 - val_loss: 0.1999
Epoch 67/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1298 - val_loss: 0.1941
Epoch 68/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1352 - val_loss: 0.2002
Epoch 69/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1510 - val_loss: 0.2043
Epoch 70/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1400 - val_loss: 0.2219
Epoch 71/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1173 - val_loss: 0.2089
Epoch 72/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1180 - val_loss: 0.2009
Epoch 73/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1173 - val_loss: 0.2056
Epoch 74/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1384 - val_loss: 0.2175
Epoch 75/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1284 - val_loss: 0.1929
Epoch 76/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1156 - val_loss: 0.2063
Epoch 77/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1202 - val_loss: 0.2206
Epoch 78/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1314 - val_loss: 0.2190
Epoch 79/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1225 - val_loss: 0.2382
Epoch 80/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1090 - val_loss: 0.2088
Epoch 81/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1180 - val_loss: 0.2179
Epoch 82/100
17/17 [==============================] - 0s 5ms/step - loss: 0.1114 - val_loss: 0.2090
Epoch 83/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1169 - val_loss: 0.1907
Epoch 84/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1143 - val_loss: 0.2081
Epoch 85/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1133 - val_loss: 0.1982
Epoch 86/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1169 - val_loss: 0.2174
Epoch 87/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1021 - val_loss: 0.2310
Epoch 88/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1036 - val_loss: 0.1998
Epoch 89/100
17/17 [==============================] - 0s 4ms/step - loss: 0.0966 - val_loss: 0.2201
Epoch 90/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1327 - val_loss: 0.2166
Epoch 91/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1038 - val_loss: 0.2148
Epoch 92/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1123 - val_loss: 0.2321
Epoch 93/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1024 - val_loss: 0.2015
Epoch 94/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1029 - val_loss: 0.2037
Epoch 95/100
17/17 [==============================] - 0s 3ms/step - loss: 0.1196 - val_loss: 0.2307
Epoch 96/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1213 - val_loss: 0.1963
Epoch 97/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1140 - val_loss: 0.2045
Epoch 98/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1211 - val_loss: 0.2202
Epoch 99/100
17/17 [==============================] - 0s 4ms/step - loss: 0.1091 - val_loss: 0.2070
Epoch 100/100
17/17 [==============================] - 0s 5ms/step - loss: 0.1046 - val_loss: 0.1935
```

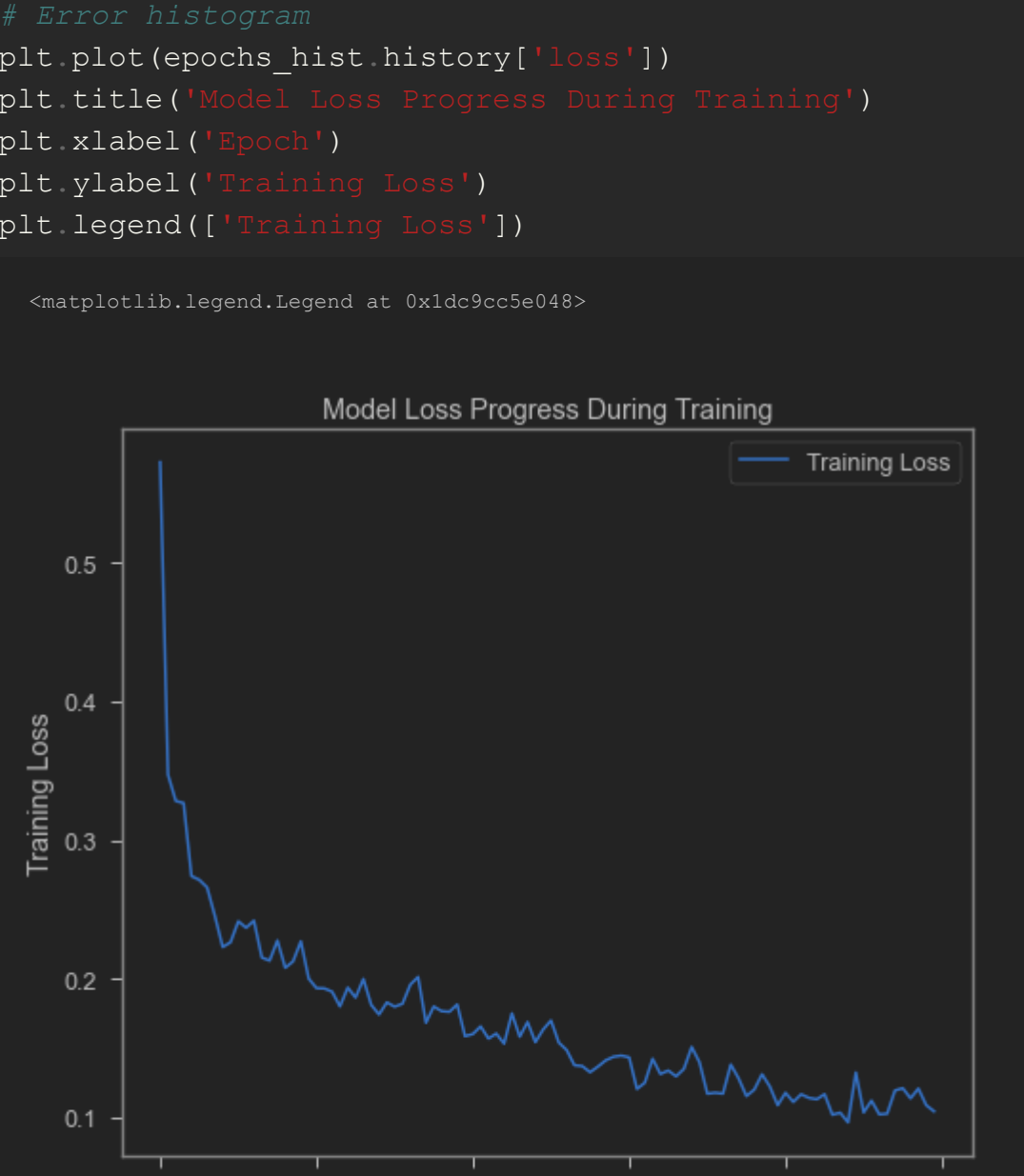
In [177]:
```
# Check the accuracy
result = ANN_model.evaluate(x_test, y_test)
accuracy_ANN = 1 - result
accuracy_ANN
```

```
3/3 [==============================] - 0s 3ms/step - loss: 0.2594

0.740573525428772
```

In [178]:
```
# Error histogram
plt.plot(epochs_hist.history['loss'])
plt.title('Model Loss Progress During Training')
plt.xlabel('Epoch')
plt.ylabel('Training Loss')
plt.legend(['Training Loss'])
```

```
<matplotlib.legend.Legend at 0x1dc9cc5e048>
```



TRAIN AND EVALUATE A DECISION TREE AND RANDOM FOREST MODELS

In [179]:
```
# import library for decision tree model
from sklearn.tree import DecisionTreeRegressor
```

In [180]:
```
# train decision tree model
DecisionTree_model = DecisionTreeRegressor()
DecisionTree_model.fit(x_train, y_train)
```

```
DecisionTreeRegressor()
```

In [181]:
```
# check accuracy
accuracy_DecisionTree = DecisionTree_model.score(x_test, y_test)
accuracy_DecisionTree
```

```
0.5130128574460989
```

In [182]:
```
# import library for random forest model
from sklearn.ensemble import RandomForestRegressor
```

In [183]:
```
# train random forest model
RandomForest_model = RandomForestRegressor(n_estimators = 80, max_depth = 12)
RandomForest_model.fit(x_train, y_train)
```

```
C:\Users\Tejas\anaconda3\lib\site-packages\ipykernel_launcher.py:3: DataConversionWarning: A column-vector y was passed when a 1
d array was expected. Please change the shape of y to (n_samples,), for example using ravel().
  This is separate from the ipykernel package so we can avoid doing imports until

RandomForestRegressor(max_depth=12, n_estimators=80)
```

In [184]:
```
# check accuracy
accuracy_RandomForest = RandomForest_model.score(x_test, y_test)
accuracy_RandomForest
```

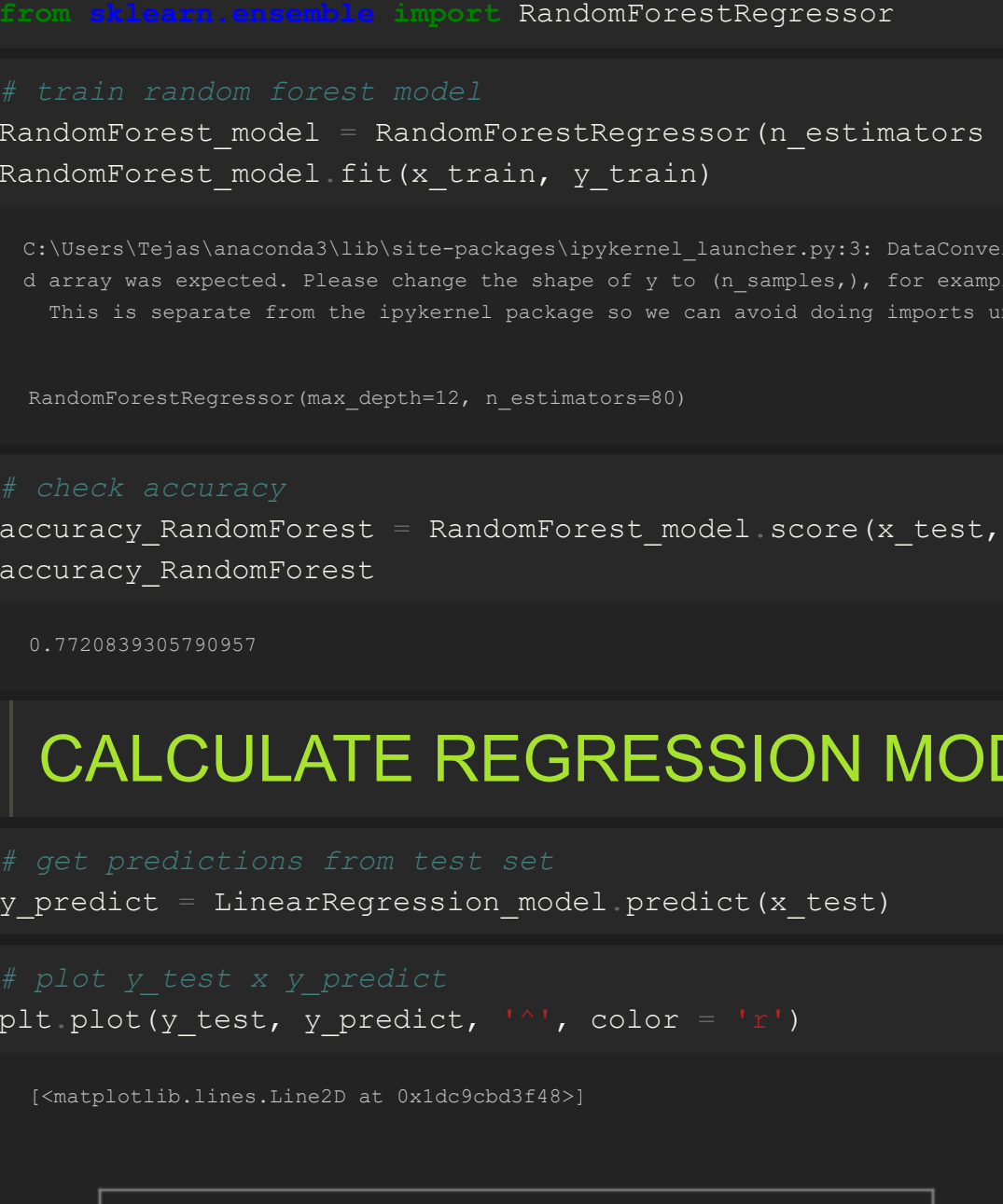
```
0.7720839305790957
```

CALCULATE REGRESSION MODEL KPIs

In [185]:
```
# get predictions from test set
y_predict = LinearRegression_model.predict(x_test)
```

In [186]:
```
# plot y_test x y_predict
plt.plot(y_test, y_predict, '^', color = 'r')
```

```
[<matplotlib.lines.Line2D at 0x1dc9cbd3f48>]
```



In [189]:
```
# get original values (inverse of scaler)
y_predict_orig = scaler_y.inverse_transform(y_predict)
y_test_orig = scaler_y.inverse_transform(y_test)
```

In [190]:
```
# plot with original values
plt.plot(y_test_orig, y_predict_orig, '^', color = 'r')
```

```
[<matplotlib.lines.Line2D at 0x1dc9cf66148>]
```

In [194]:
```
# get the length of test data (n) and no. of independent variables (k)
k = x_test.shape[1]
n = len(x_test)
n
```

```
75
```

In [195]:

```python
# import libraries
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
from math import sqrt
```

In [203]:

```python
# calculate RMSE
RMSE = float(np.sqrt(mean_squared_error(y_test_orig, y_predict_orig)))
```

In [197]:

```python
# calculate MSE
MSE = mean_squared_error(y_test_orig, y_predict_orig)
```

In [198]:

```python
# calculate MAE
MAE = mean_absolute_error(y_test_orig, y_predict_orig)
```

In [199]:

```python
# calculate R2 score
r2 = r2_score(y_test_orig, y_predict_orig)
```

In [200]:

```python
# calculate adjusted R2 score
adj_r2 = 1 - (1 - r2)*(n - 1) / (n - k - 1)
```

In [204]:

```python
# print errors
print('RMSE =', RMSE, '\nMSE =', MSE, '\nMAE =', MAE, '\nR square =', r2, '\nAdjusted R squ
are =', adj_r2)
```

```
RMSE = 0.05857467471880446
MSE = 0.0034309925184137506
MAE = 0.04359252597839725
R square = 0.8171136993579109
Adjusted R square = 0.7980061754102299
```

In [230]:

```python
# predict with custom inputs
new_predict = LinearRegression_model.predict(np.array([[340, 120, 1, 5.0, 5.0, 10.0, 1]]))
new_predict
```

```
array([[71.93029724]])
```

THE END