Implement the polynomial regression model on the weather dataset. Use Min temp, and Max Temp and rain fall variable as input. for the output, i need all the learned coefficients, and the scatter plot, and the best fit curve generated by the polynomial regression.

In [60]:

```
import numpy as np
import pandas as pd
import os
import missingno as msno
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from scipy import stats
from sklearn.linear_model import LogisticRegression
from imblearn.over_sampling import SMOTE
from collections import Counter
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score, f1_score
from xgboost import XGBClassifier
from sklearn.ensemble import RandomForestRegressor
from sklearn.naive_bayes import BernoulliNB
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestRegressor
import warnings

warnings.filterwarnings("ignore")
df = pd.read_csv('weatherAUS.csv')
df.head()
```

Out[60]:

	Date	Location	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	WindGustDir	WindGustSpeed	WindDir9am	WindDir
0	2008-12-01	Albury	13.4	22.9	0.6	NaN	NaN	W	44.0	W	W
1	2008-12-02	Albury	7.4	25.1	0.0	NaN	NaN	WNW	44.0	NNW	W
2	2008-12-03	Albury	12.9	25.7	0.0	NaN	NaN	WSW	46.0	W	W
3	2008-12-04	Albury	9.2	28.0	0.0	NaN	NaN	NE	24.0	SE	
4	2008-12-05	Albury	17.5	32.3	1.0	NaN	NaN	W	41.0	ENE	

Selecting MinTemp, MaxTemp and Rainfall

In [61]:

```
df = df[["MinTemp","MaxTemp","Rainfall"]]
m=len(df)
df.head()
```

Out[61]:

	MinTemp	MaxTemp	Rainfall

	MinTemp	MaxTemp	Rainfall
1	7.4	25.1	0.0
2	12.9	25.7	0.0
3	9.2	28.0	0.0
4	17.5	32.3	1.0

Fill in missing values

In [62]:

```
(df.isnull().sum()/len(df))*100
```

Out[62]:

```
MinTemp     1.020899
MaxTemp     0.866905
Rainfall    2.241853
dtype: float64
```

In [63]:

```
df['MinTemp']=df['MinTemp'].fillna(df['MinTemp'].mean())
df['MaxTemp']=df['MaxTemp'].fillna(df['MaxTemp'].mean())
df['Rainfall']=df['Rainfall'].fillna(df['Rainfall'].mean())
```

In [64]:

```
X = df[["MinTemp","MaxTemp"]]
X.head()
```

Out[64]:

	MinTemp	MaxTemp
0	13.4	22.9
1	7.4	25.1
2	12.9	25.7
3	9.2	28.0
4	17.5	32.3

In [65]:

```
X["MaxTemp_2"] = X["MaxTemp"]**2
X["MinTemp_3"] = X["MinTemp"]**3
X.head()
```

Out[65]:

	MinTemp	MaxTemp	MaxTemp_2	MinTemp_3
0	13.4	22.9	524.41	2406.104
1	7.4	25.1	630.01	405.224
2	12.9	25.7	660.49	2146.689
3	9.2	28.0	784.00	778.688
4	17.5	32.3	1043.29	5359.375

In [66]:

```
Y = df["Rainfall"]
Y.head()
```

Out[66]:

```
0    0.6
1    0.0
2    0.0
3    0.0
4    1.0
Name: Rainfall, dtype: float64
```

Printing the learned coefficients

In [67]:

```
X = X/X.max()
import numpy as np
theta = np.array([0]*len(X.columns))

def hypothesis(X, theta):
    y1 = theta*X
    return np.sum(y1, axis=1)

def cost(X, y, theta):
    y1 = hypothesis(X, theta)
    return sum(np.sqrt((y1-y)**2))/(2*m)

def gradientDescent(X, y, theta, alpha, epoch):
    J=[]
    k=0
    while k < epoch:
        y1 = hypothesis(X, theta)
        for c in range(0, len(X.columns)):
            theta[c] = theta[c] - alpha*sum((y1-y)* X.iloc[:, c])/m
        j = cost(X, y, theta)
        J.append(j)
        k += 1
    return J, j, theta

theta = np.array([0.0]*len(X.columns))
J, j, theta = gradientDescent(X, Y, theta, 0.05, 700)

print(theta)
```

```
[ 5.74109838  1.03039018 -2.59051049  1.31962543]
```

In [68]:

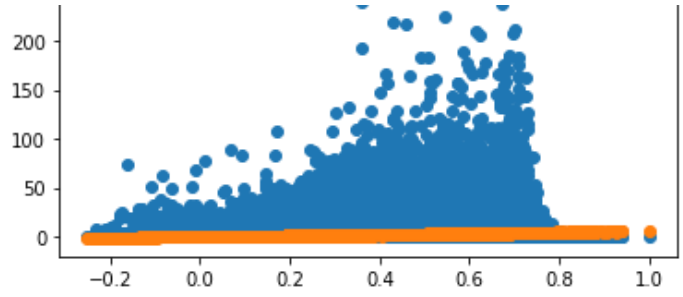
```
y_hat = theta*X
y_hat = np.sum(y_hat,axis=1)
y_hat.head()
```

Out[68]:

```
0    2.254231
1    1.099222
2    2.068382
3    1.306412
4    2.669002
dtype: float64
```

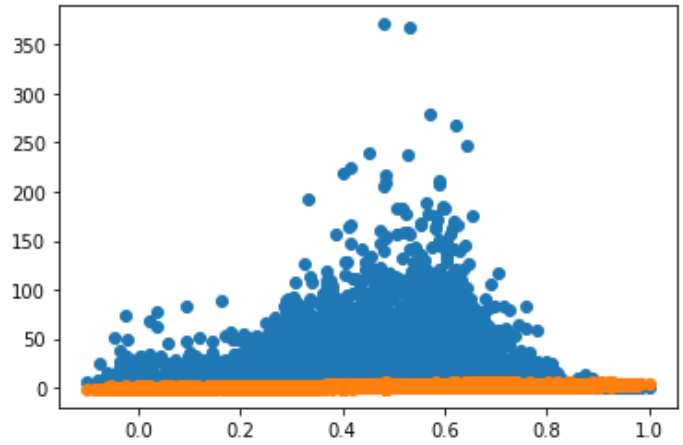
In [69]:

```
%matplotlib inline
import matplotlib.pyplot as plt
plt.figure()
plt.scatter(x=X["MinTemp"],y= Y)
plt.scatter(x=X['MinTemp'], y=y_hat)
plt.show()
```



In [70]:

```
plt.figure()
plt.scatter(x=X["MaxTemp"],y= Y)
plt.scatter(x=X['MaxTemp'], y=y_hat)
plt.show()
```



Best Fit Curve

In [73]:

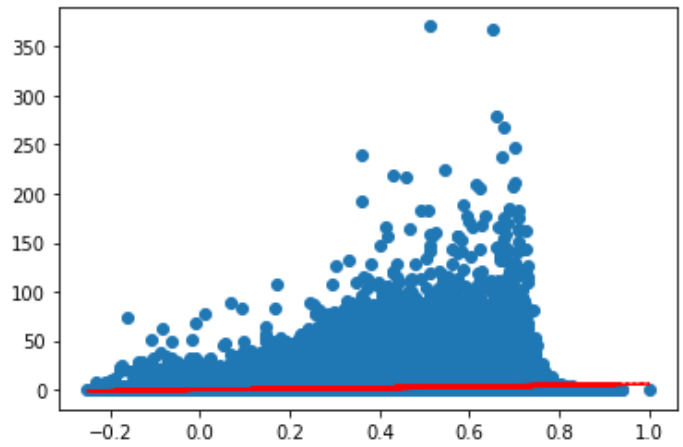
```
from numpy import arange
from pandas import read_csv
from scipy.optimize import curve_fit
from matplotlib import pyplot

pyplot.scatter(X["MinTemp"], Y)

x_line = X["MinTemp"]

y_line = y_hat

pyplot.plot(x_line, y_line, '--', color='red')
pyplot.show()
```



In [74]:

```
from numpy import arange
```

```
from pandas import read_csv
from scipy.optimize import curve_fit
from matplotlib import pyplot

pyplot.scatter(X["MaxTemp"], Y)

x_line = X["MaxTemp"]

y_line = y_hat

pyplot.plot(x_line, y_line, '--', color='red')
pyplot.show()
```