EXNO-3-DS

AIM:

To read the given data and perform Feature Encoding and Transformation process and save the data to a file.

ALGORITHM:

STEP 1:Read the given Data. STEP 2:Clean the Data Set using Data Cleaning Process. STEP 3:Apply Feature Encoding for the feature in the data set. STEP 4:Apply Feature Transformation for the feature in the data set. STEP 5:Save the data to the file.

FEATURE ENCODING:

1. Ordinal Encoding An ordinal encoding involves mapping each unique label to an integer value. This type of encoding is really only appropriate if there is a known relationship between the categories. This relationship does exist for some of the variables in our dataset, and ideally, this should be harnessed when preparing the data.
2. Label Encoding Label encoding is a simple and straight forward approach. This converts each value in a categorical column into a numerical value. Each value in a categorical column is called Label.
3. Binary Encoding Binary encoding converts a category into binary digits. Each binary digit creates one feature column. If there are n unique categories, then binary encoding results in the only log(base 2)^n features.
4. One Hot Encoding We use this categorical data encoding technique when the features are nominal(do not have any order). In one hot encoding, for each level of a categorical feature, we create a new variable. Each category is mapped with a binary variable containing either 0 or 1. Here, 0 represents the absence, and 1 represents the presence of that category.

Methods Used for Data Transformation:

1. FUNCTION TRANSFORMATION

• Log Transformation • Reciprocal Transformation • Square Root Transformation • Square Transformation

2. POWER TRANSFORMATION

• Boxcox method • Yeojohnson method

CODING AND OUTPUT:

from google.colab import drive

drive.mount('/content/drive')

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

```
Mounted at /content/drive
```

ls drive/MyDrive/'Colab Notebooks'/Data_set.csv

```
'drive/MyDrive/Colab Notebooks/Data_set.csv'
```

ls drive/MyDrive/'Colab Notebooks'/Data_to_Transform.csv

```
'drive/MyDrive/Colab Notebooks/Data_to_Transform.csv'
```

ls drive/MyDrive/'Colab Notebooks'/'Encoding Data.csv'

```
'drive/MyDrive/Colab Notebooks/Encoding Data.csv'
```

df=pd.read_csv('drive/MyDrive/Colab Notebooks/Encoding Data.csv')

df

	id	bin_1	bin_2	nom_0	ord_2
0	0	F	N	Red	Hot
1	1	F	Y	Blue	Warm
2	2	F	N	Blue	Cold
3	3	F	N	Green	Warm
4	4	T	N	Red	Cold
5	5	T	N	Green	Hot
6	6	F	N	Red	Cold
7	7	T	N	Red	Cold
8	8	F	N	Blue	Warm
9	9	F	Y	Red	Hot

ORDINAL ENCODER

from sklearn.preprocessing import LabelEncoder,OrdinalEncoder

pm=['Hot','Warm','Cold']

e1=OrdinalEncoder(categories=[pm])

e1.fit_transform(df[["ord_2"]])

```
array([[0.],
       [1.],
       [2.],
       [1.],
       [2.],
       [0.],
       [2.],
       [2.],
       [1.],
       [0.]])
```

df['bo2']=e1.fit_transform(df[["ord_2"]])

df

	id	bin_1	bin_2	nom_0	ord_2	bo2
0	0	F	N	Red	Hot	0.0
1	1	F	Y	Blue	Warm	1.0
2	2	F	N	Blue	Cold	2.0
3	3	F	N	Green	Warm	1.0
4	4	T	N	Red	Cold	2.0
5	5	T	N	Green	Hot	0.0
6	6	F	N	Red	Cold	2.0
7	7	T	N	Red	Cold	2.0
8	8	F	N	Blue	Warm	1.0
9	9	F	Y	Red	Hot	0.0

LABEL ENCODER

le=LabelEncoder()

dfc=df.copy()

dfc['ord_2']=le.fit_transform(df[["ord_2"]])

dfc

```
/usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_label.py:114: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape c
  y = column_or_1d(y, warn=True)
```

	id	bin_1	bin_2	nom_0	ord_2	bo2
0	0	F	N	Red	1	0.0
1	1	F	Y	Blue	2	1.0
2	2	F	N	Blue	0	2.0
3	3	F	N	Green	2	1.0
4	4	T	N	Red	0	2.0
5	5	T	N	Green	1	0.0
6	6	F	N	Red	0	2.0
7	7	T	N	Red	0	2.0
8	8	F	N	Blue	2	1.0
9	9	F	Y	Red	1	0.0

ONEHOT ENCODER

from sklearn.preprocessing import OneHotEncoder

ohe=OneHotEncoder()

df2=df.copy()

enc=pd.DataFrame(ohe.fit_transform(df2[['nom_0']]))

df2=pd.concat([df2,enc],axis=1)

df2

	id	bin_1	bin_2	nom_0	ord_2	bo2	0
0	0	F	N	Red	Hot	0.0	(0, 2)\t1.0
1	1	F	Y	Blue	Warm	1.0	(0, 0)\t1.0
2	2	F	N	Blue	Cold	2.0	(0, 0)\t1.0
3	3	F	N	Green	Warm	1.0	(0, 1)\t1.0
4	4	T	N	Red	Cold	2.0	(0, 2)\t1.0
5	5	T	N	Green	Hot	0.0	(0, 1)\t1.0
6	6	F	N	Red	Cold	2.0	(0, 2)\t1.0
7	7	T	N	Red	Cold	2.0	(0, 2)\t1.0
8	8	F	N	Blue	Warm	1.0	(0, 0)\t1.0
9	9	F	Y	Red	Hot	0.0	(0, 2)\t1.0

```
pd.get_dummies(df2,columns=["nom_0"])
```

	id	bin_1	bin_2	ord_2	bo2	0	nom_0_Blue	nom_0_Green	nom_0_Red
0	0	F	N	Hot	0.0	(0, 2)\t1.0	False	False	True
1	1	F	Y	Warm	1.0	(0, 0)\t1.0	True	False	False
2	2	F	N	Cold	2.0	(0, 0)\t1.0	True	False	False
3	3	F	N	Warm	1.0	(0, 1)\t1.0	False	True	False
4	4	T	N	Cold	2.0	(0, 2)\t1.0	False	False	True
5	5	T	N	Hot	0.0	(0, 1)\t1.0	False	True	False
6	6	F	N	Cold	2.0	(0, 2)\t1.0	False	False	True
7	7	T	N	Cold	2.0	(0, 2)\t1.0	False	False	True
8	8	F	N	Warm	1.0	(0, 0)\t1.0	True	False	False
9	9	F	Y	Hot	0.0	(0, 2)\t1.0	False	False	True

BINARY ENCODER

pip install --upgrade category_encoders

```
Collecting category_encoders
  Downloading category_encoders-2.6.4-py2.py3-none-any.whl.metadata (8.0 kB)
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (1.26.4)
Requirement already satisfied: scikit-learn>=0.20.0 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (1.5.2)
Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (1.13.1)
Requirement already satisfied: statsmodels>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (0.14.4)
Requirement already satisfied: pandas>=1.0.5 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (2.2.2)
Requirement already satisfied: patsy>=0.5.1 in /usr/local/lib/python3.10/dist-packages (from category_encoders) (1.0.1)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.5->category_encoders) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.5->category_encoders) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.5->category_encoders) (2024.2)
Requirement already satisfied: joblib>=1.2.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=0.20.0->category_encoders) (1.4.2)
Requirement already satisfied: threadpoolctl>=3.1.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=0.20.0->category_encoders) (3.5.0)
Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.10/dist-packages (from statsmodels>=0.9.0->category_encoders) (24.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.8.2->pandas>=1.0.5->category_encoders) (1.16.0)
Downloading category_encoders-2.6.4-py2.py3-none-any.whl (82 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 82.0/82.0 kB 4.7 MB/s eta 0:00:00
Installing collected packages: category_encoders
Successfully installed category_encoders-2.6.4
```

from category_encoders import BinaryEncoder

df=pd.read_csv('drive/MyDrive/data.csv')

df

dfb=pd.concat([df,nd],axis=1)

dfb

	id	bin_1	bin_2	City	Ord_1	Ord_2	Target	Ord_2_0	Ord_2_1	Ord_2_2
0	0	F	N	Delhi	Hot	High School	0	0	0	1
1	1	F	Y	Bangalore	Warm	Masters	1	0	1	0
2	2	M	N	Mumbai	Very Hot	Diploma	1	0	1	1
3	3	M	Y	Chennai	Cold	Bachelors	0	1	0	0
4	4	M	Y	Delhi	Cold	Bachelors	1	1	0	0
5	5	F	N	Delhi	Very Hot	Masters	0	0	1	0
6	6	M	N	Chennai	Warm	PhD	1	1	0	1
7	7	F	N	Chennai	Hot	High School	1	0	0	1
8	8	M	N	Delhi	Very Hot	High School	0	0	0	1
9	9	F	Y	Delhi	Warm	PhD	0	1	0	1

TARGET ENCODER

from category_encoders import TargetEncoder

te=TargetEncoder()

cc=df.copy()

new=te.fit_transform(X=cc["City"],y=cc["Target"])

cc=pd.concat([cc,new],axis=1)

cc

	id	bin_1	bin_2	City	Ord_1	Ord_2	Target	City
0	0	F	N	Delhi	Hot	High School	0	0.445272
1	1	F	Y	Bangalore	Warm	Masters	1	0.565054
2	2	M	N	Mumbai	Very Hot	Diploma	1	0.565054
3	3	M	Y	Chennai	Cold	Bachelors	0	0.525744
4	4	M	Y	Delhi	Cold	Bachelors	1	0.445272
5	5	F	N	Delhi	Very Hot	Masters	0	0.445272
6	6	M	N	Chennai	Warm	PhD	1	0.525744
7	7	F	N	Chennai	Hot	High School	1	0.525744
8	8	M	N	Delhi	Very Hot	High School	0	0.445272
9	9	F	Y	Delhi	Warm	PhD	0	0.445272

FEATURE TRANSFORMATION

from scipy import stats

df=pd.read_csv('drive/MyDrive/Data_to_Transform.csv')

df

	Moderate Positive Skew	Highly Positive Skew	Moderate Negative Skew	Highly Negative Skew
0	0.899990	2.895074	11.180748	9.027485
1	1.113554	2.962385	10.842938	9.009762
2	1.156830	2.966378	10.817934	9.006134
3	1.264131	3.000324	10.764570	9.000125
4	1.323914	3.012109	10.753117	8.981296
...	...	...	...	...
9995	14.749050	16.289513	-2.980821	-3.254882
9996	14.854474	16.396252	-3.147526	-3.772332
9997	15.262103	17.102991	-3.517256	-4.717950
9998	15.269983	17.628467	-4.689833	-5.670496
9999	16.204517	18.052331	-6.335679	-7.036091

10000 rows × 4 columns

df.skew()

	0
Moderate Positive Skew	0.656308
Highly Positive Skew	1.271249
Moderate Negative Skew	-0.690244
Highly Negative Skew	-1.201891

dtype: float64

np.log(df["Highly Positive Skew"])

	Highly Positive Skew
0	1.063011
1	1.085995
2	1.087342
3	1.098720
4	1.102640
...	...
9995	2.790522
9996	2.797053
9997	2.839253
9998	2.869515
9999	2.893275

10000 rows × 1 columns

dtype: float64

```
np.reciprocal(df["Moderate Positive Skew"])
```

	Moderate Positive Skew
0	1.111123
1	0.898026
2	0.864431
3	0.791057
4	0.755336
...	...
9995	0.067801
9996	0.067320
9997	0.065522
9998	0.065488
9999	0.061711

10000 rows × 1 columns

dtype: float64

np.sqrt(df["Highly Positive Skew"])

	Highly Positive Skew
0	1.701492
1	1.721158
2	1.722317
3	1.732144
4	1.735543
...	...
9995	4.036027
9996	4.049229
9997	4.135576
9998	4.198627
9999	4.248803

10000 rows × 1 columns

dtype: float64

```
np.square(df["Highly Positive Skew"])
```

	Highly Positive Skew
0	8.381452
1	8.775724
2	8.799396
3	9.001942
4	9.072800
...	...
9995	265.348230
9996	268.837091
9997	292.512290
9998	310.762852
9999	325.886637

10000 rows × 1 columns

dtype: float64

df["Highly Positive Skew_boxcox"],parameters=stats.boxcox(df["Highly Positive Skew"])

df

	Moderate Positive Skew	Highly Positive Skew	Moderate Negative Skew	Highly Negative Skew	Highly Positive Skew_boxcox
0	0.899990	2.895074	11.180748	9.027485	0.812909
1	1.113554	2.962385	10.842938	9.009762	0.825921
2	1.156830	2.966378	10.817934	9.006134	0.826679
3	1.264131	3.000324	10.764570	9.000125	0.833058
4	1.323914	3.012109	10.753117	8.981296	0.835247
...	...	...	...	...	...
9995	14.749050	16.289513	-2.980821	-3.254882	1.457701
9996	14.854474	16.396252	-3.147526	-3.772332	1.459189
9997	15.262103	17.102991	-3.517256	-4.717950	1.468681
9998	15.269983	17.628467	-4.689833	-5.670496	1.475357
9999	16.204517	18.052331	-6.335679	-7.036091	1.480525

10000 rows × 5 columns

df["Moderate Negative Skew_yeojohnson"],parameters=stats.yeojohnson(df["Moderate Negative Skew"])

df

	Moderate Positive Skew	Highly Positive Skew	Moderate Negative Skew	Highly Negative Skew	Highly Positive Skew_boxcox	Moderate Negative Skew_yeojohnson
0	0.899990	2.895074	11.180748	9.027485	0.812909	29.137807
1	1.113554	2.962385	10.842938	9.009762	0.825921	27.885274
2	1.156830	2.966378	10.817934	9.006134	0.826679	27.793303
3	1.264131	3.000324	10.764570	9.000125	0.833058	27.597362
4	1.323914	3.012109	10.753117	8.981296	0.835247	27.555370
...	...	...	...	...	...	...
9995	14.749050	16.289513	-2.980821	-3.254882	1.457701	-1.949345
9996	14.854474	16.396252	-3.147526	-3.772332	1.459189	-2.028952
9997	15.262103	17.102991	-3.517256	-4.717950	1.468681	-2.199693
9998	15.269983	17.628467	-4.689833	-5.670496	1.475357	-2.697151
9999	16.204517	18.052331	-6.335679	-7.036091	1.480525	-3.311401

10000 rows × 6 columns

df.skew()

	0
Moderate Positive Skew	0.656308
Highly Positive Skew	1.271249
Moderate Negative Skew	-0.690244
Highly Negative Skew	-1.201891
Highly Positive Skew_boxcox	0.023089
Moderate Negative Skew_yeojohnson	-0.119651

dtype: float64

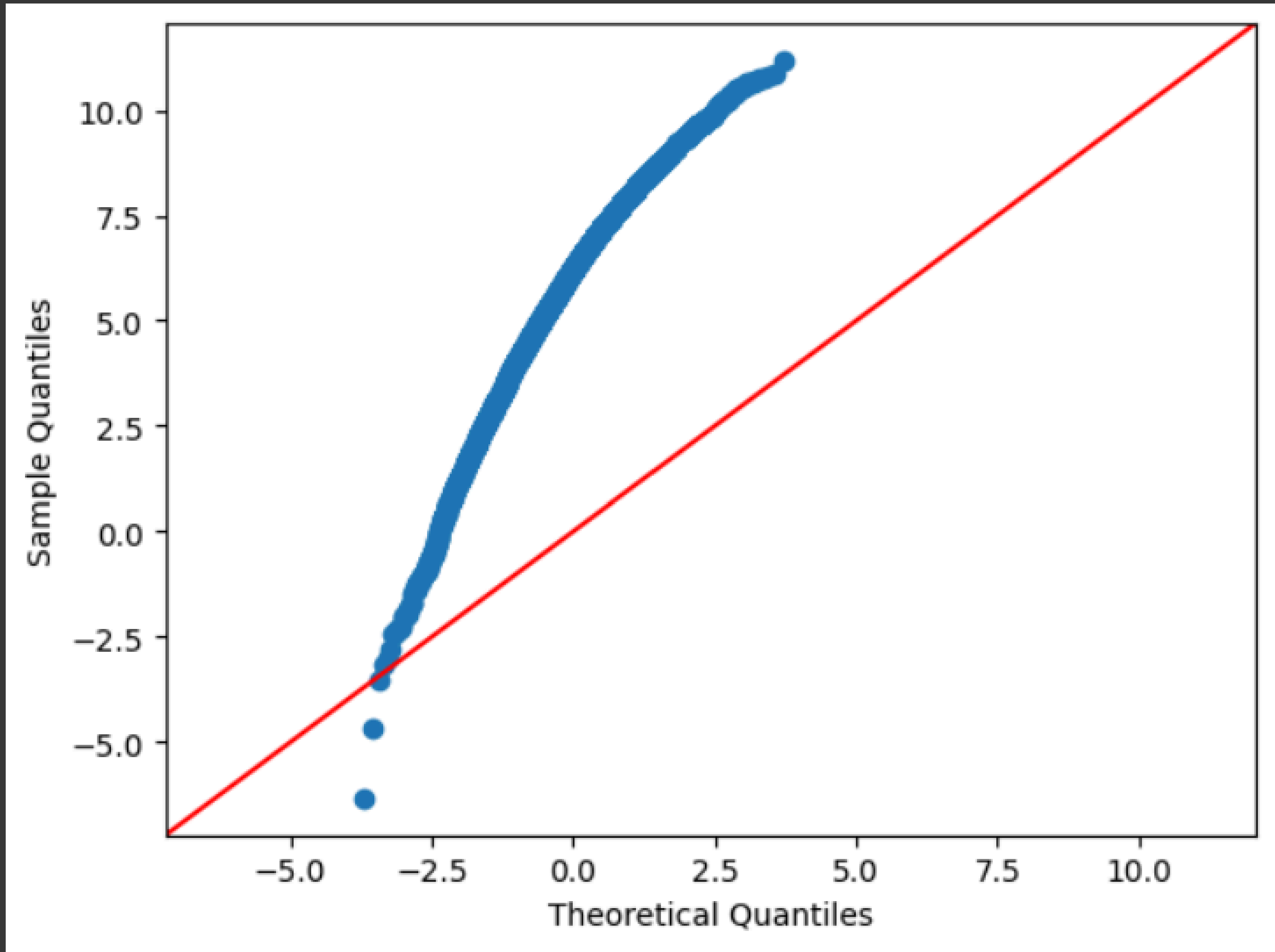
import seaborn as sns

import statsmodels.api as sm

import matplotlib.pyplot as plt

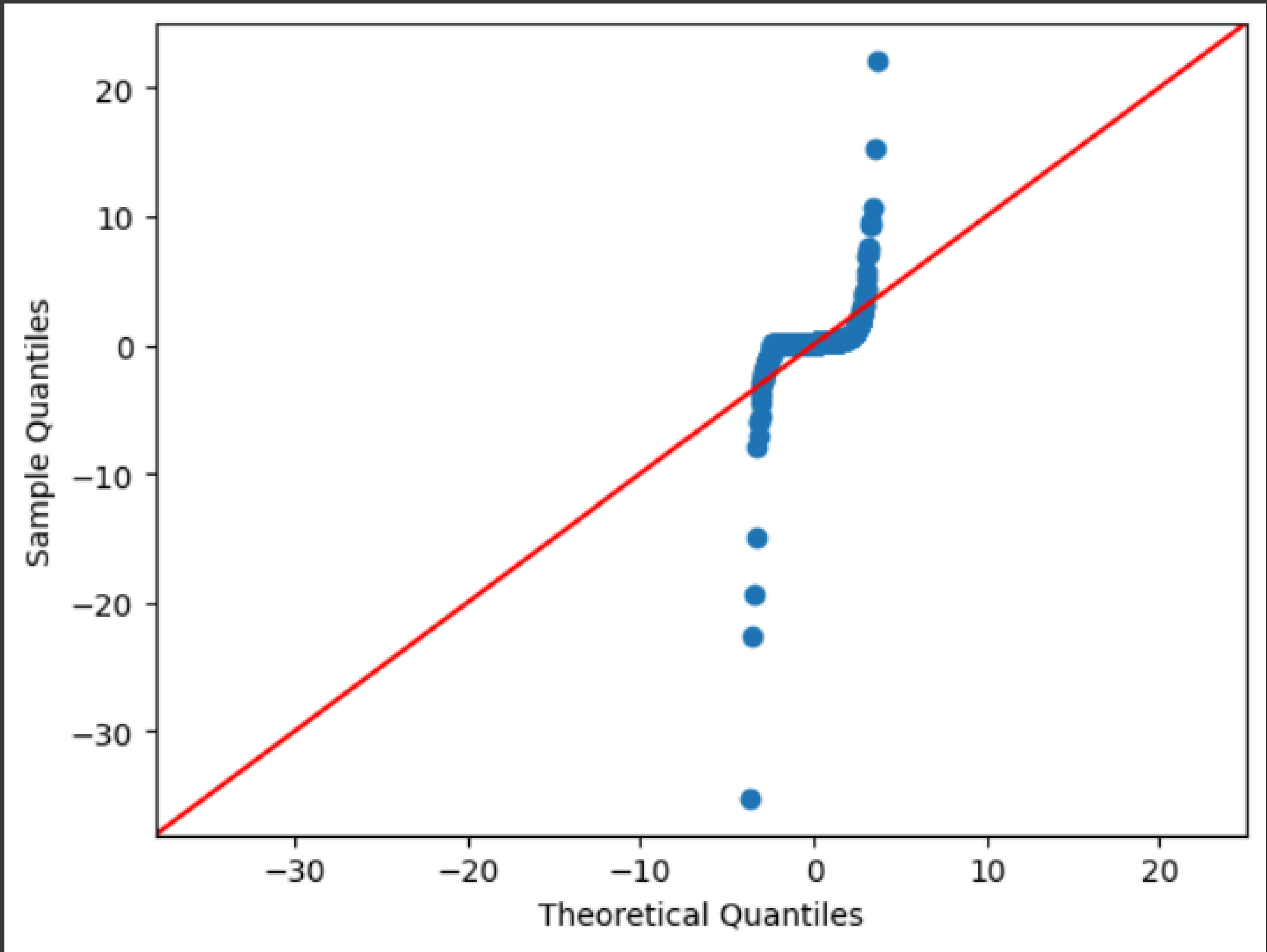
sm.qqplot(df["Moderate Negative Skew"],line='45')

plt.show()



sm.qqplot(np.reciprocal(df["Moderate Negative Skew"]),line='45')

plt.show()


Sample Quantiles
Theoretical Quantiles
20
10
0
−10
−20
−30
−30
−20
−10
0
10
20

RESULT:

THUS THE ABOVE CODE IS EXECUETED SUCCESSFULLY