Scaling

1:- Standard Scaling

Standard scaling is a method of scaling the data such that the distribution of the data is centered around 0, with a standard deviation of 1. This is done by subtracting the mean of the data from each data point and then dividing by the standard deviation of the data. This is a very common method of scaling data, and is used in many machine learning algorithms.

The formula is as follows:

$z = (x - \mu) / \sigma$

In [1]:
```
# import libraries
import pandas as pd
from sklearn.preprocessing import StandardScaler, MinMaxScaler, MaxAbsScaler
```

In [2]:
```
# make an example dataset
df = {
    'age': [25,30,35,40,45],
    'height': [165,170,175,180,185],
    'weight': [55,60,65,70,75]
}

# conver this data to pandas datafram
df = pd.DataFrame(df)
df.head()
```

Out[2]:

	age	height	weight
0	25	165	55
1	30	170	60
2	35	175	65
3	40	180	70
4	45	185	75

In [3]:
```
# import the scalar
scalar = StandardScaler()

# fit the scalar on data
scaled_df = scalar.fit_transform(df)
scaled_df
# convert this data into a pandas dataframe
scaled_df = pd.DataFrame(scaled_df, columns=df.columns)
scaled_df.head()
```

Out[3]:

	age	height	weight
0	-1.414214	-1.414214	-1.414214
1	-0.707107	-0.707107	-0.707107
2	0.000000	0.000000	0.000000
3	0.707107	0.707107	0.707107
4	1.414214	1.414214	1.414214

min-max scalar

In [4]:
```
# import the scalar
scalar = MinMaxScaler()
```

```
# fit the scalar on data
scaled_df = scalar.fit_transform(df)
# convert this data into a pandas dataframe
scaled_df = pd.DataFrame(scaled_df, columns=df.columns)
scaled_df.head()
```

Out[4]:

	age	height	weight
0	0.00	0.00	0.00
1	0.25	0.25	0.25
2	0.50	0.50	0.50
3	0.75	0.75	0.75
4	1.00	1.00	1.00

Max ABS scalar

In [5]:

```
# import the scalar
scalar = MaxAbsScaler()

# fit the scalar on data
scaled_df = scalar.fit_transform(df)
scaled_df
# convert this data into a pandas dataframe
scaled_df = pd.DataFrame(scaled_df, columns=df.columns)
scaled_df.head()
```

Out[5]:

	age	height	weight
0	0.555556	0.891892	0.733333
1	0.666667	0.918919	0.800000
2	0.777778	0.945946	0.866667
3	0.888889	0.972973	0.933333
4	1.000000	1.000000	1.000000

In [6]:
```
from sklearn.preprocessing import RobustScaler

# import the scalar
scalar = RobustScaler()

# fit the scalar on data
scaled_df = scalar.fit_transform(df)
scaled_df
# convert this data into a pandas dataframe
scaled_df = pd.DataFrame(scaled_df, columns=df.columns)
scaled_df.head()
```

Out[6]:

	age	height	weight
0	-1.0	-1.0	-1.0
1	-0.5	-0.5	-0.5
2	0.0	0.0	0.0
3	0.5	0.5	0.5
4	1.0	1.0	1.0

Transformation

In [7]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

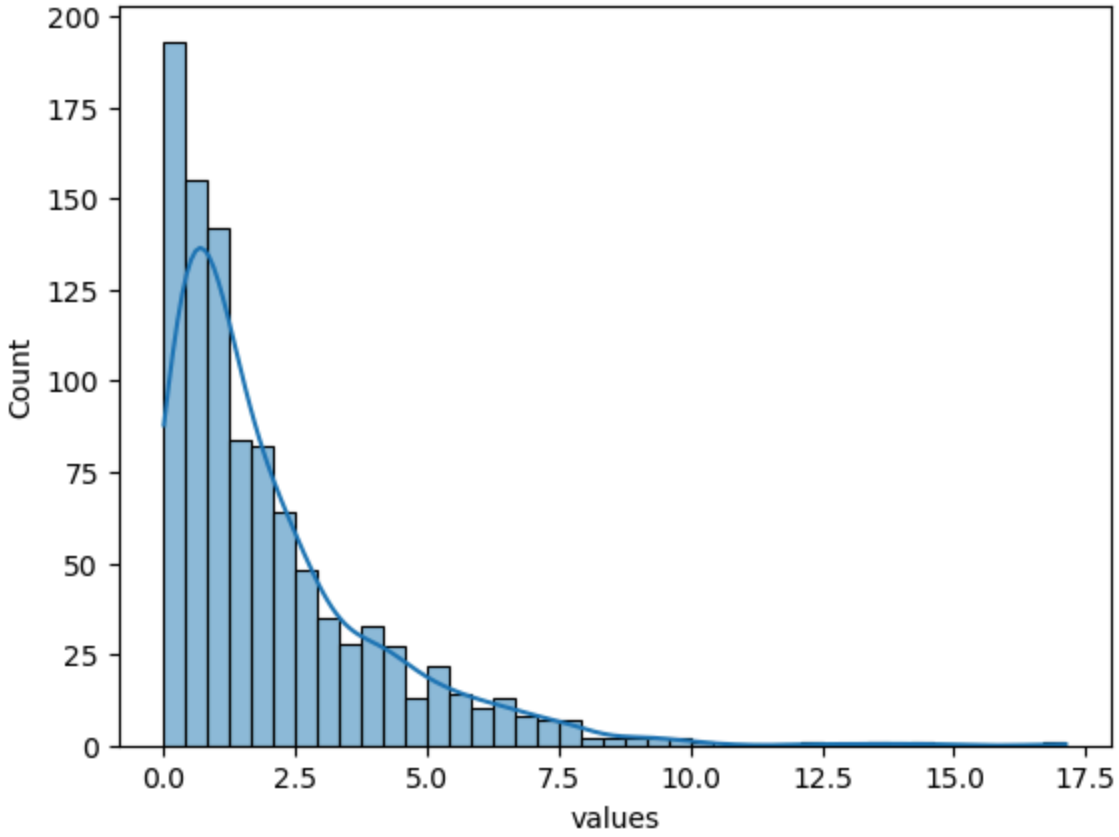
In [8]:
```
# generate non-normal data (exponential Distribution)
np.random.seed(0)
df = np.random.exponential(size=1000, scale=2)
df = pd.DataFrame(df, columns=['values'])
df.head()
```

Out[8]:

	values
0	1.591749
1	2.511862
2	1.846446
3	1.574402
4	1.102097

In [9]:
```
sns.histplot(df['values'], kde=True);
```

```
C:\Users\ustb\.anaconda\anwaar\Lib\site-packages\seaborn\_oldcore.py:1119: FutureWarning: use_inf_as_na option is dep
recated and will be removed in a future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```



In [10]:
```
from sklearn.preprocessing import PowerTransformer
from sklearn.preprocessing import QuantileTransformer

pt_boxcox = PowerTransformer(method='box-cox', standardize=False)
pt_yeo_johnson = PowerTransformer(method='yeo-johnson', standardize=False)
qt_normal = QuantileTransformer(output_distribution='normal')

# boxbcox k liay data must be postive
df['Box_Cox'] = pt_boxcox.fit_transform(df[['values']] + 1)
df['Yeo_Johnson'] = pt_yeo_johnson.fit_transform(df[['values']])
df['Quantile'] = qt_normal.fit_transform(df[['values']])


df.head()
```

Out[10]:

	values	Box_Cox	Yeo_Johnson	Quantile
0	1.591749	0.787485	0.787485	0.162552
1	2.511862	0.980233	0.980233	0.587964
2	1.846446	0.849553	0.849553	0.286135
3	1.574402	0.782945	0.782945	0.157469
4	1.102097	0.639848	0.639848	-0.154930

In [11]:
```
# creata hostograms for all columns using sns.hist and kde=true use a for loop
for col in df.columns:
    sns.histplot(df[col], kde=True)
    plt.show()
```

```
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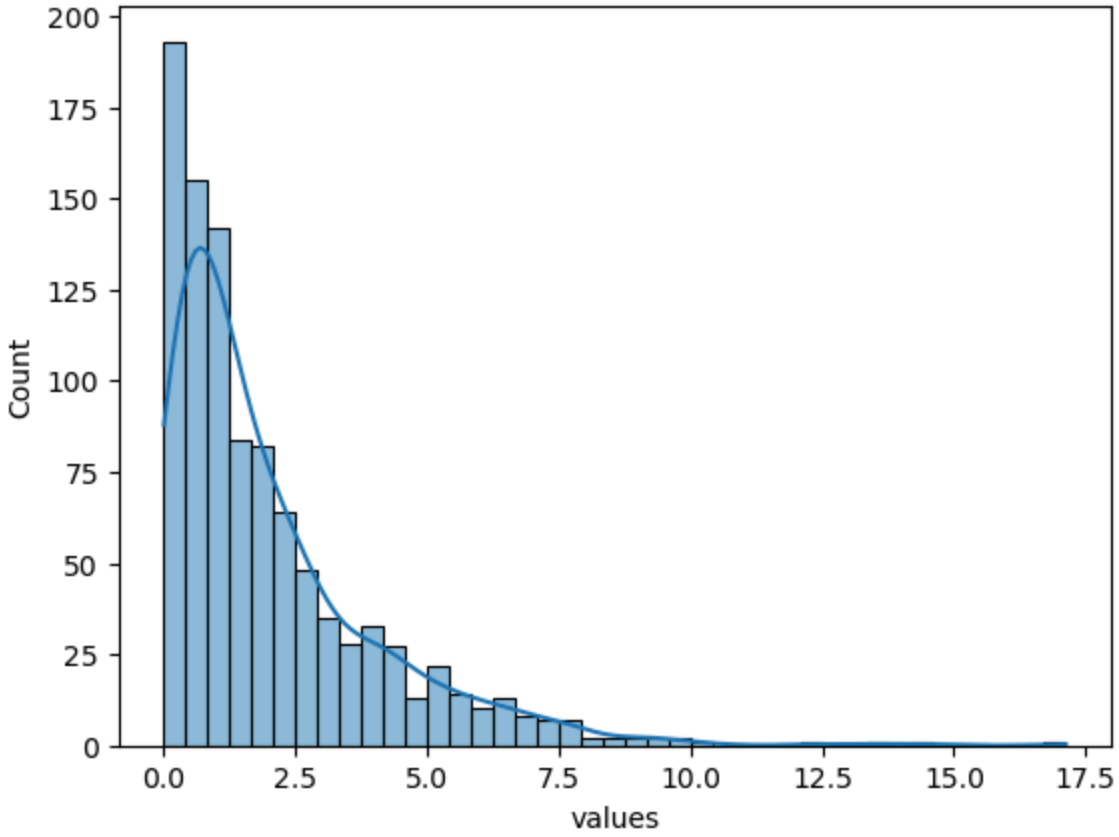


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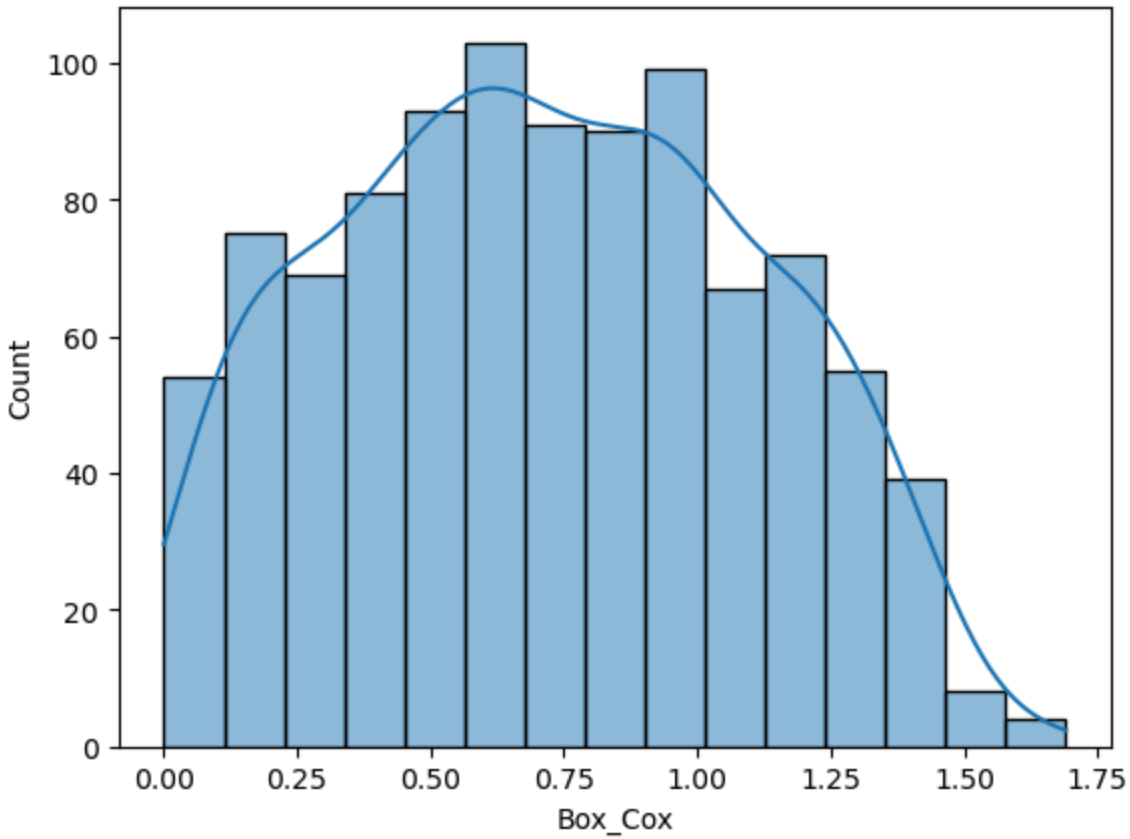


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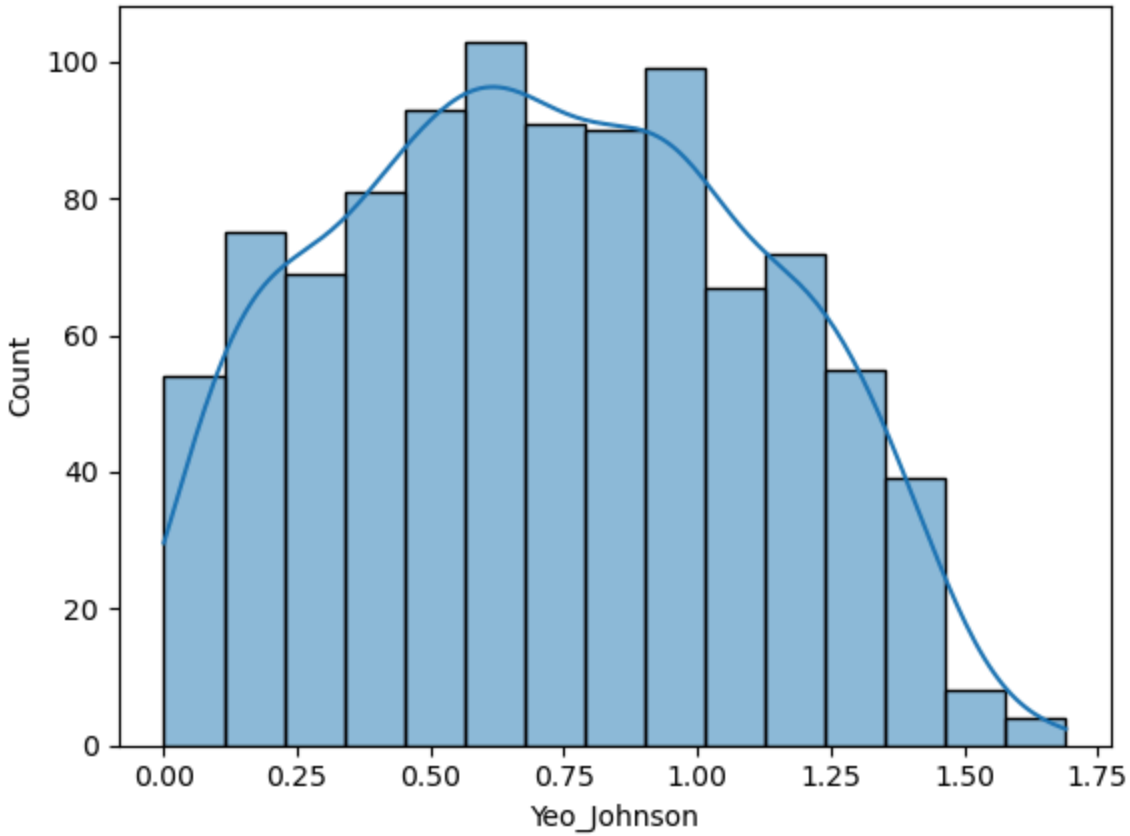


```
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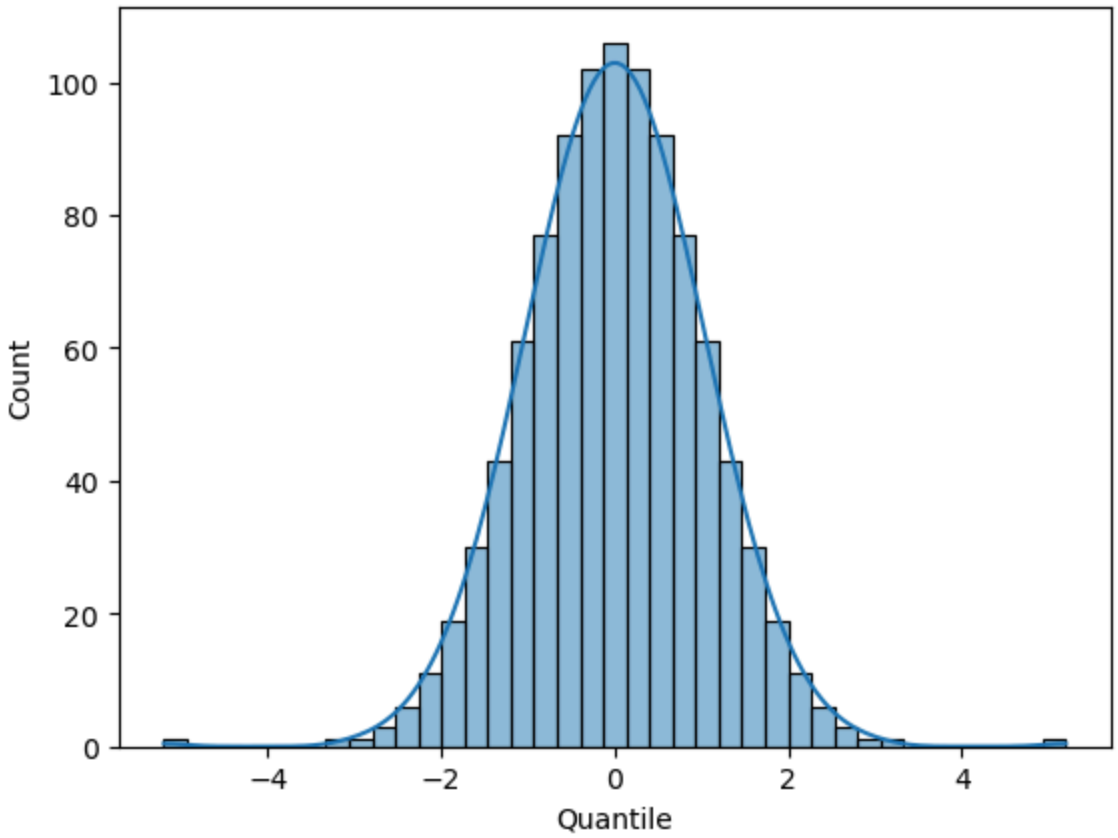
  with pd.option_context('mode.use_inf_as_na', True):
```



Normalization

L2 Normalization:

Rescales each sample (row) to have unit norm. This type of normalization is often used when dealing with text data. The L2 norm is calculated as the square root of the sum of the squared vector values.

In [12]:
```
from sklearn.preprocessing import Normalizer
data = [[1, 1, 1], [1, 1, 0], [1, 0, 0]]
normalizer = Normalizer(norm='l2')
print(normalizer.fit_transform(data))
```

```
[[0.57735027 0.57735027 0.57735027]
 [0.70710678 0.70710678 0.        ]
 [1.         0.         0.        ]]
```

L1 Normalization:

Also rescales each sample (row) but with a different approach, ensuring the sum of the absolute values is 1 in each row. The L1 norm is calculated as the sum of the absolute vector values. Example:

In [13]:
```
from sklearn.preprocessing import Normalizer
data = [[1, 1, 1], [1, 1, 0], [1, 0, 0]]
normalizer = Normalizer(norm='l1')
print(normalizer.fit_transform(data))
```

```
[[0.33333333 0.33333333 0.33333333]
 [0.5        0.5        0.        ]
 [1.         0.         0.        ]]
```

1:- Z-score normalization

*Standard Scalar

2:- Min-Max normalization

*Min-Max Scalar

Log Transformation

In [14]:
```
import pandas as pd
import numpy as np
```

```
# example dataset with skewed values
df = { "Values": [1,5,10,20,50,100,200,500,1000,2000,5000,10000,20000,50000,100000]}
df = pd.DataFrame(df)
df.head()
```

Out[14]:

	Values
0	1
1	5
2	10
3	20
4	50

In [15]:
```
df['log_values'] = np.log(df['Values'])
df
```

Out[15]:

	Values	log_values
0	1	0.000000
1	5	1.609438
2	10	2.302585
3	20	2.995732
4	50	3.912023
5	100	4.605170
6	200	5.298317
7	500	6.214608
8	1000	6.907755
9	2000	7.600902
10	5000	8.517193
11	10000	9.210340
12	20000	9.903488
13	50000	10.819778
14	100000	11.512925

In [16]:
```
for col in df.columns:
    sns.histplot(df[col], kde=True)
    plt.show()
```

```
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  with pd.option_context('mode.use_inf_as_na', True):
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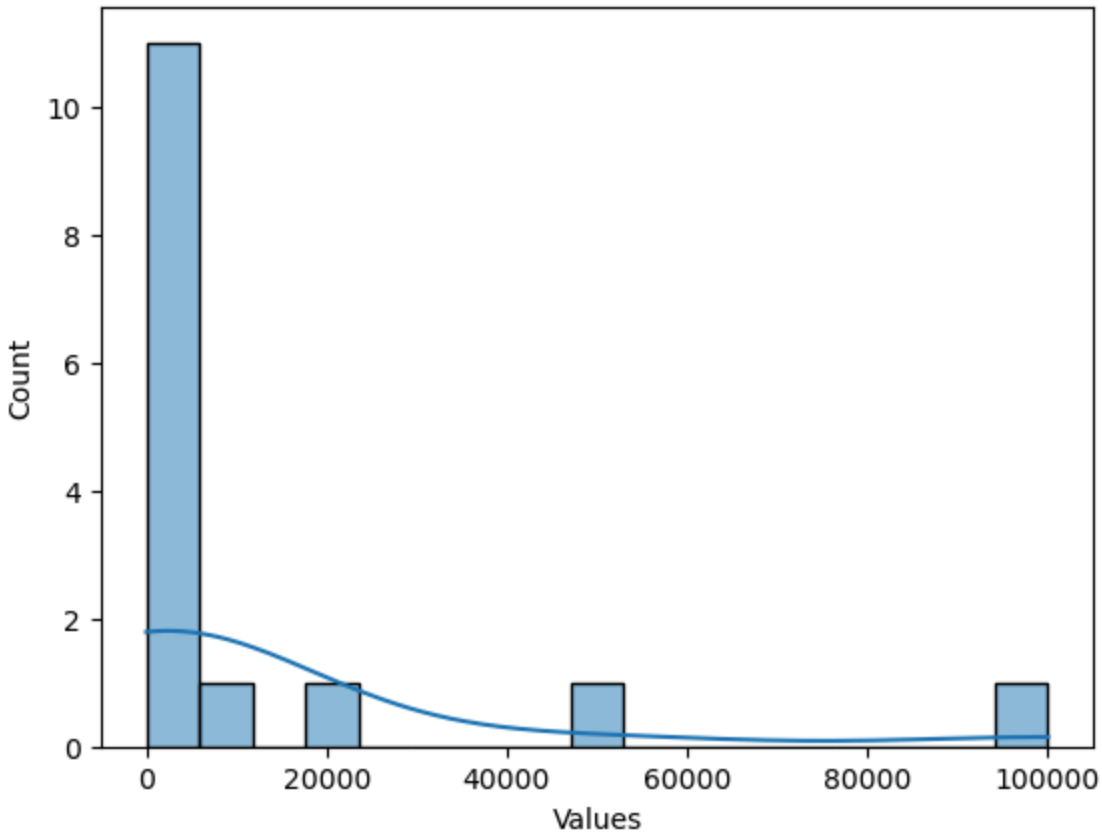


```
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  with pd.option_context('mode.use_inf_as_na', True):
```

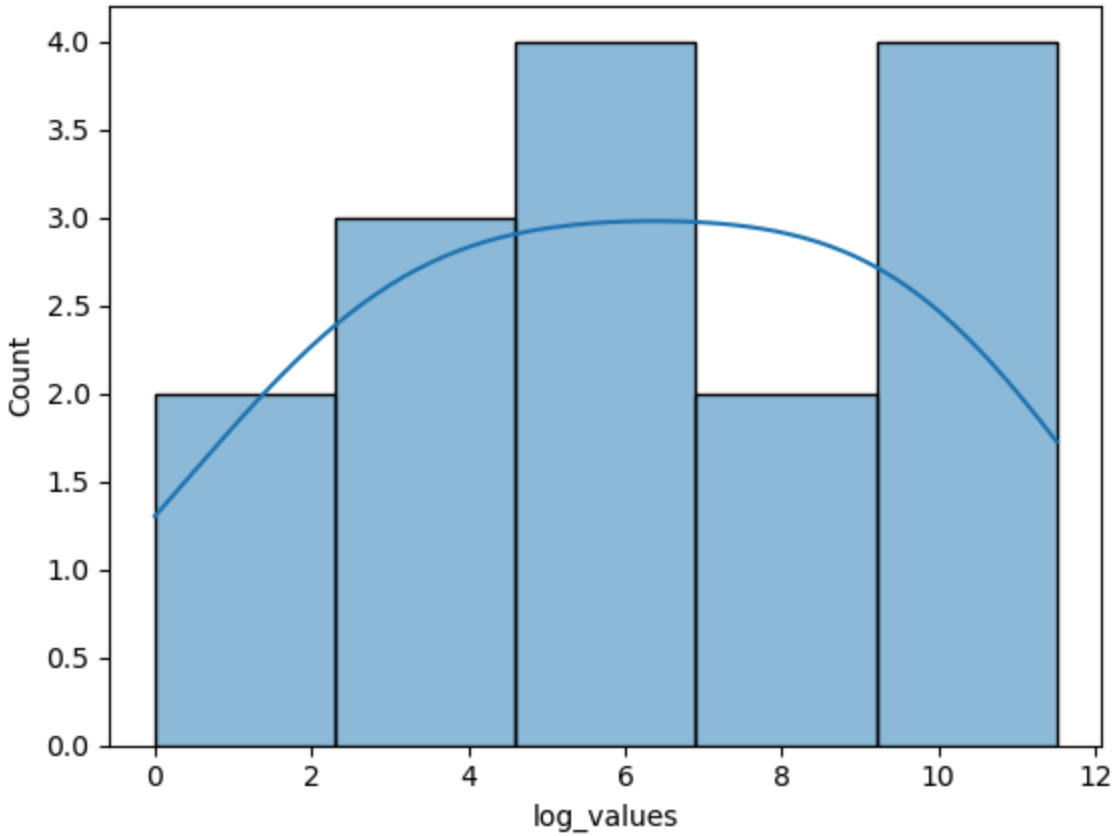

In [ ]: