Name of Student : AHMED ALI ANSARI **ID No : 1402-2020**

Task :

1. Create a code for given dataset to find anomaly using sklearn library.?

Answer :

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

import sklearn
from sklearn.cluster import DBSCAN
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import normalize
from sklearn.decomposition import PCA
```

In [2]:
```
X = pd.read_csv('./CC GENERAL.csv')
X = X.drop('CUST_ID', axis = 1) #irrelevant id column

X.fillna(method ='ffill', inplace = True)

print(X.head())
```

```
      BALANCE  BALANCE_FREQUENCY  PURCHASES  ONEOFF_PURCHASES  \
0   40.900749           0.818182      95.40              0.00
1  3202.467416           0.909091       0.00              0.00
2  2495.148862           1.000000     773.17            773.17
3  1666.670542           0.636364    1499.00           1499.00
4   817.714335           1.000000      16.00             16.00

   INSTALLMENTS_PURCHASES  CASH_ADVANCE  PURCHASES_FREQUENCY  \
0                    95.4      0.000000             0.166667
1                     0.0   6442.945483             0.000000
2                     0.0      0.000000             1.000000
3                     0.0    205.788017             0.083333
4                     0.0      0.000000             0.083333

   ONEOFF_PURCHASES_FREQUENCY  PURCHASES_INSTALLMENTS_FREQUENCY  \
0                    0.000000                          0.083333
1                    0.000000                          0.000000
```

In [3]:
```
print(X.columns)
print(f"number of rows: {len(X)}")
```

```
Index(['BALANCE', 'BALANCE_FREQUENCY', 'PURCHASES', 'ONEOFF_PURCHASES',
       'INSTALLMENTS_PURCHASES', 'CASH_ADVANCE', 'PURCHASES_FREQUENCY',
       'ONEOFF_PURCHASES_FREQUENCY', 'PURCHASES_INSTALLMENTS_FREQUENCY',
       'CASH_ADVANCE_FREQUENCY', 'CASH_ADVANCE_TRX', 'PURCHASES_TRX',
       'CREDIT_LIMIT', 'PAYMENTS', 'MINIMUM_PAYMENTS', 'PRC_FULL_PAYMENT',
       'TENURE'],
      dtype='object')
number of rows: 8950
```

In [4]:
```
X.describe()
```

Out[4]:

	BALANCE	BALANCE_FREQUENCY	PURCHASES	ONEOFF_PURCHASES	INSTALLMENTS_PURCHASES	CASH_ADVANCE	PURCHASES_FREQUENCY
count	8950.000000	8950.000000	8950.000000	8950.000000	8950.000000	8950.000000	8950.000000
mean	1564.474828	0.877271	1003.204834	592.437371	411.067645	978.871112	0.490351
std	2081.531879	0.236904	2136.634782	1659.887917	904.338115	2097.163877	0.401371
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	128.281915	0.888889	39.635000	0.000000	0.000000	0.000000	0.083333
50%	873.385231	1.000000	361.280000	38.000000	89.000000	0.000000	0.500000
75%	2054.140036	1.000000	1110.130000	577.405000	468.637500	1113.821139	0.916667
max	19043.138560	1.000000	49039.570000	40761.250000	22500.000000	47137.211760	1.000000

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In [5]:
```
#scale and normalize
scaler = StandardScaler()

X_s = scaler.fit_transform(X)
X_norm = pd.DataFrame(normalize(X_s))
```

In [6]:
```
pca = PCA(n_components = 2)
X_reduce = pca.fit_transform(X_norm)
X_reduce = pd.DataFrame(X_reduce)
X_reduce.columns = list([f'P{i}' for i in range(1, len(X_reduce.columns)+1)])
```

In [7]:
```
db_model = DBSCAN(eps = 0.05, min_samples = 10).fit(X_reduce)
labels = db_model.labels_
```

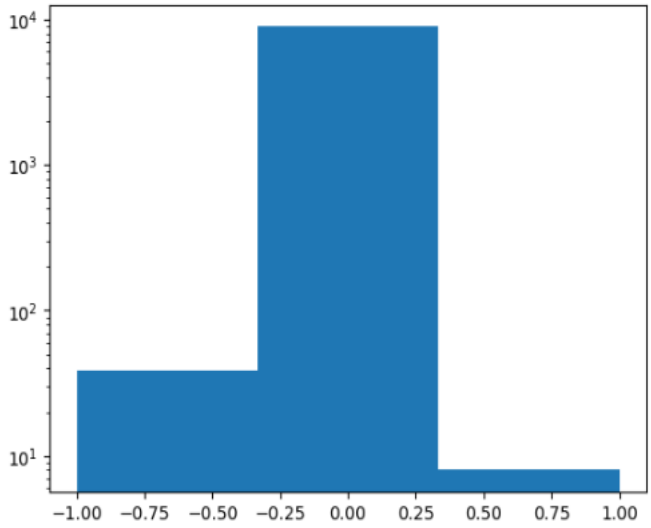
In [8]:
```
np.unique(labels)
```

Out[8]:
```
array([-1,  0,  1], dtype=int64)
```

In [9]:
```
np.histogram(labels, bins=len(np.unique(labels)))
```

Out[9]:
```
(array([  39, 8903,    8], dtype=int64),
 array([-1.        , -0.33333333,  0.33333333,  1.        ]))
```

In [10]:
```
plt.hist(labels, bins=len(np.unique(labels)), log=True)
plt.show()
```



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In [11]:
```
n_clusters = len(np.unique(labels))-1
anomaly = list(labels).count(-1)
print(f'Clusters: {n_clusters}')
print(f'Abnormal points: {anomaly}')
```

```
Clusters: 2
Abnormal points: 39
```

In [12]:
```
X_anomaly = X.iloc[np.argwhere(labels==-1).reshape((-1,))]
print(X_anomaly.head())
```

```
         BALANCE  BALANCE_FREQUENCY  PURCHASES  ONEOFF_PURCHASES  \
86   7069.950386                1.0    1603.78           1445.14
87   8181.251131                1.0    2258.01           1318.78
109  6644.201651                1.0    4478.75           2721.59
120  8504.876253                1.0    6724.26           4100.08
468  6426.639738                1.0    4462.86           2816.46

     INSTALLMENTS_PURCHASES  CASH_ADVANCE  PURCHASES_FREQUENCY  \
86                   158.64   5626.004046                  1.0
87                   939.23   5251.228934                  1.0
109                 1757.16   7205.520805                  1.0
120                 2624.18   1686.599777                  1.0
468                 1646.40   4599.625146                  1.0

     ONEOFF_PURCHASES_FREQUENCY  PURCHASES_INSTALLMENTS_FREQUENCY  \
86                     0.833333                         1.000000
87                     0.750000                         1.000000
109                    0.916667                         1.000000
120                    0.916667                         1.000000
468                    0.833333                         0.916667
```

In [13]:
```
colours = {}
colours[0] = 'r'
colours[1] = 'g'
colours[2] = 'b'
colours[-1] = 'k'

cvec = [colours[label] for label in labels]

r = plt.scatter(X_reduce['P1'], X_reduce['P2'], color ='r');
g = plt.scatter(X_reduce['P1'], X_reduce['P2'], color ='g');
b = plt.scatter(X_reduce['P1'], X_reduce['P2'], color ='b');
k = plt.scatter(X_reduce['P1'], X_reduce['P2'], color ='k');

plt.figure(figsize =(9, 9))
plt.scatter(X_reduce['P1'], X_reduce['P2'], c = cvec)

plt.legend((r, g, b, k), ('Label 0', 'Label 1', 'Label 2', 'Label -1'))
plt.show()
```

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