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

In [2]:
```
# use pandas to import csv file
df = pd.read_csv("churn3.csv")
# too see max columns
pd.set_option('display.max_columns',None)
# print dataframe
df
```

Out[2]:

	customer_id	age	gender	dependents	occupation	city	customer_nw_category	branc
0	1	66	1.0	0.0	1.0	187.0	2	
1	2	35	1.0	0.0	1.0	NaN	2	
2	4	31	1.0	0.0	0.0	146.0	2	
3	5	90	NaN	NaN	1.0	1020.0	2	
4	6	42	1.0	2.0	1.0	1494.0	3	
...	...	...	...	...	...	...	...	
28377	30297	10	0.0	0.0	2.0	1020.0	2	
28378	30298	34	0.0	0.0	1.0	1046.0	2	
28379	30299	47	1.0	0.0	0.0	1096.0	2	
28380	30300	50	1.0	3.0	1.0	1219.0	3	
28381	30301	18	1.0	0.0	2.0	1232.0	2	

28382 rows × 9 columns

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 28382 entries, 0 to 28381
Data columns (total 9 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   customer_id           28382 non-null  int64  
 1   age                   28382 non-null  int64  
 2   gender                27857 non-null  float64
 3   dependents            25919 non-null  float64
 4   occupation            28302 non-null  float64
 5   city                  27579 non-null  float64
 6   customer_nw_category  28382 non-null  int64  
 7   branch_code           28382 non-null  int64  
 8   churn                 28382 non-null  int64  
dtypes: float64(4), int64(5)
memory usage: 1.9 MB
```

In [5]:
```
#New dataframe
new_df = df
#Checking for null values
print(new_df.isnull().sum())
print("Missing values distribution: ")
print(new_df.isnull().mean())
```

```
customer_id               0
age                       0
gender                  525
dependents             2463
occupation               80
city                    803
customer_nw_category      0
branch_code               0
churn                     0
dtype: int64
Missing values distribution:
customer_id             0.000000
age                     0.000000
gender                  0.018498
dependents              0.086780
occupation              0.002819
city                    0.028293
customer_nw_category    0.000000
branch_code             0.000000
churn                   0.000000
dtype: float64
```

In [9]:
```
# Replace missing values with the mean of the column
mean_value = df['city'].mean()
df['city'].fillna(mean_value, inplace=True)
```

In [10]:
```
# Replace missing values with the mode of the column
mode_value = df['gender'].mode()[0]
df['gender'].fillna(mode_value, inplace=True)
```

In [11]:
```
# Replace missing values with the mode of the column
mode_value = df['occupation'].mode()[0]
df['occupation'].fillna(mode_value, inplace=True)
```

In [12]:
```
# Replace missing values with the mode of the column
mode_value = df['dependents'].mode()[0]
df['dependents'].fillna(mode_value, inplace=True)
```

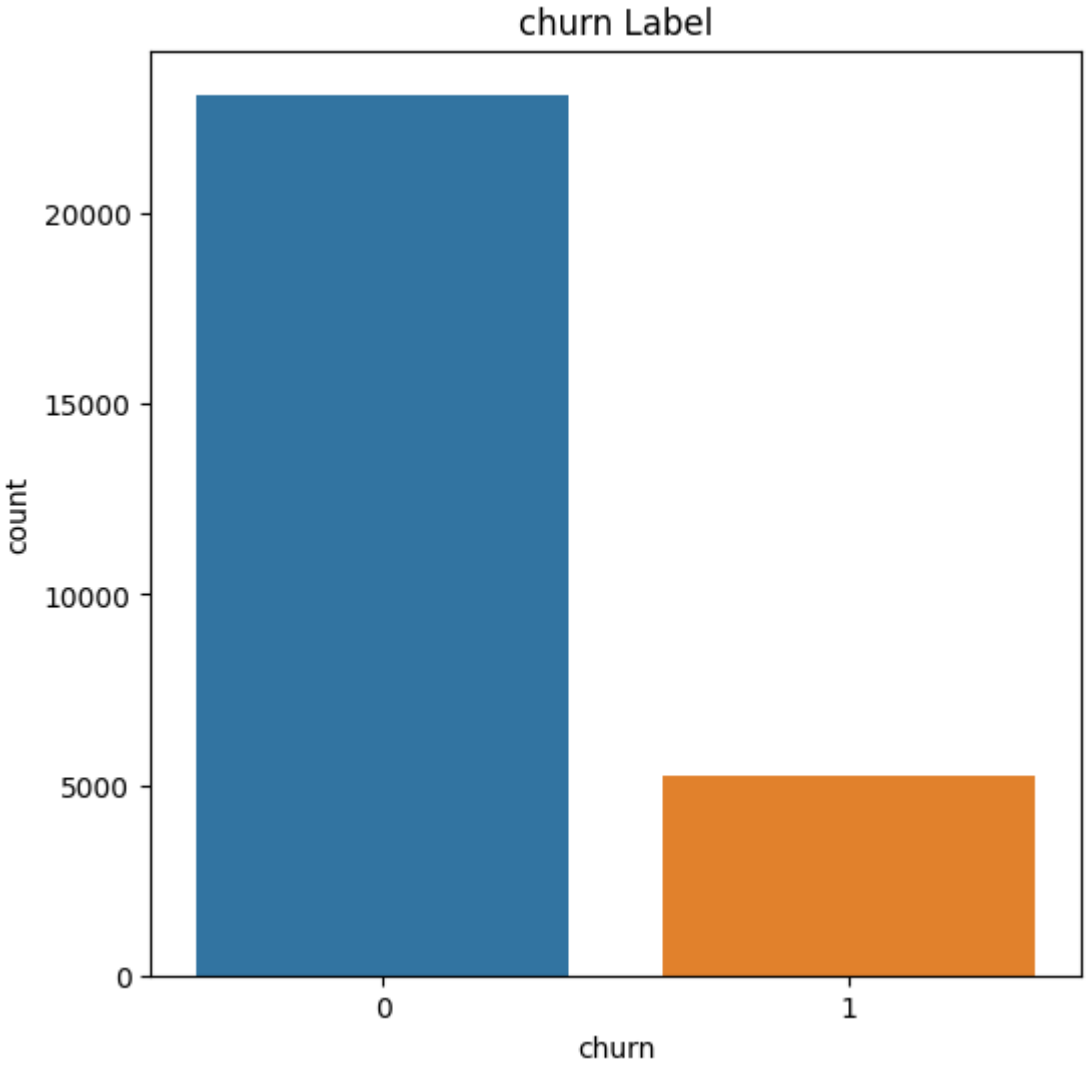
In [13]:
```
df
```

Out[13]:

	customer_id	age	gender	dependents	occupation	city	customer_nw_category
0	1	66	1.0	0.0	1.0	187.000000	2
1	2	35	1.0	0.0	1.0	796.109576	2
2	4	31	1.0	0.0	0.0	146.000000	2
3	5	90	1.0	0.0	1.0	1020.000000	2
4	6	42	1.0	2.0	1.0	1494.000000	3
...	...	...	...	...	...	...	...
28377	30297	10	0.0	0.0	2.0	1020.000000	2
28378	30298	34	0.0	0.0	1.0	1046.000000	2
28379	30299	47	1.0	0.0	0.0	1096.000000	2
28380	30300	50	1.0	3.0	1.0	1219.000000	3
28381	30301	18	1.0	0.0	2.0	1232.000000	2

28382 rows × 9 columns

In [15]:
```
df.churn.value_counts()
plt.figure(figsize=(6,6))
sns.countplot(x='churn', data=new_df)
plt.title('churn Label')
plt.show()
```



In [16]:
```
from sklearn.datasets import make_classification
X, y = make_classification(n_classes=2, class_sep=0.5,
weights=[0.05, 0.95], n_informative=2, n_redundant=0, flip_y=0,
n_features=2, n_clusters_per_class=1, n_samples=1000, random_state=10)
```

In [17]:
```
from sklearn.model_selection import train_test_split
# split into 75:25 ratio
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.25, ra
```

In [18]:
```
#KNN classifer
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
#Accuracy and Confusion matrix
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
cm = confusion_matrix(y_test, y_pred)
print(accuracy_score(y_test, model.predict(X_test)))
cm
```

```
0.98
```

Out[18]:
```
array([[ 10,   5],
       [  0, 235]], dtype=int64)
```

In [20]:
```
#Naive Bayes Classifier
x = df.drop(["churn"], axis = 1)
y = df.churn.values
from sklearn.model_selection import train_test_split

from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.3, ran
from sklearn.naive_bayes import GaussianNB
nb = GaussianNB()
nb.fit(x_train, y_train)
print("Naive Bayes score: ",nb.score(x_test, y_test))
```

```
Naive Bayes score:  0.8124486200822079
```

In [34]:
```
#split dataset in features and target variable
feature_cols = ['dependents', 'gender', 'occupation','customer_nw_category']
X = df[feature_cols] # Features
y = df['churn'] # Target variable
```

In [35]:
```
# Split dataset into training set and test set
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, randc
```

In [36]:
```
from sklearn.tree import DecisionTreeClassifier # Import Decision Tree Classif
# Create Decision Tree classifer object
clf = DecisionTreeClassifier()

# Train Decision Tree Classifer
clf = clf.fit(X_train,y_train)

#Predict the response for test dataset
y_pred = clf.predict(X_test)
```

In [37]:
```
from sklearn import metrics #Import scikit-learn metrics module for accuracy c
# Model Accuracy, how often is the classifier correct?
print("Accuracy:",metrics.accuracy_score(y_test, y_pred))
```

```
Accuracy: 0.8153954553461336
```

In [ ]:

In [ ]: