15TH_SEPTEMBER_ASSIGNMENT

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Steps:

1.import the necessary libraries

2.import the dataset

3.Handling null values

4.outlier detection---surya

5.Seperate Dependent and independent variables

6.Encoding

7.splitting into training and testing set

8.Feature scaling

1.import the necessary libraries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
```

2.import the dataset

```
#.csv  .tsv ,json,.excel
dataset=pd.read_csv("Titanic-Dataset.csv")
#dataset=pd.read_csv(r"D:\SmartBridge\VIT_morning_slot\Churn_Modelling.csv")
```

```
dataset
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN
...	...	...	...	...	...	...	...	...	...	...	...
886	887	0	2	Montvila, Rev. Juozas	male	27.0	0	0	211536	13.0000	NaN
887	888	1	1	Graham, Miss. Margaret Edith	female	19.0	0	0	112053	30.0000	B42
888	889	0	3	Johnston, Miss. Catherine Helen "Carrie"	female	NaN	1	2	W./C. 6607	23.4500	NaN
889	890	1	1	Behr, Mr. Karl Howell	male	26.0	0	0	111369	30.0000	C148
890	891	0	3	Dooley, Mr. Patrick	male	32.0	0	0	370376	7.7500	NaN

891 rows × 12 columns

```
dataset.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN

```
dataset.tail()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
886	887	0	2	Montvila, Rev. Juozas	male	27.0	0	0	211536	13.00	NaN	S
887	888	1	1	Graham, Miss. Margaret Edith	female	19.0	0	0	112053	30.00	B42	S
888	889	0	3	Johnston, Miss. Catherine Helen "Carrie"	female	NaN	1	2	W./C. 6607	23.45	NaN	S
889	890	1	1	Behr, Mr. Karl Howell	male	26.0	0	0	111369	30.00	C148	C
890	891	0	3	Dooley, Mr. Patrick	male	32.0	0	0	370376	7.75	NaN	Q

```
dataset.shape
```

```
(891, 12)
```

```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Survived     891 non-null    int64  
 2   Pclass       891 non-null    int64  
 3   Name         891 non-null    object 
 4   Sex          891 non-null    object 
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64  
 7   Parch        891 non-null    int64  
 8   Ticket       891 non-null    object 
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object 
 11  Embarked     889 non-null    object 
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

```
dataset.describe()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

```
corr=dataset.corr()
corr
```

```
<ipython-input-9-f22ca9e9dc13>:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version,
  corr=dataset.corr()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
PassengerId	1.000000	-0.005007	-0.035144	0.036847	-0.057527	-0.001652	0.012658
Survived	-0.005007	1.000000	-0.338481	-0.077221	-0.035322	0.081629	0.257307
Pclass	-0.035144	-0.338481	1.000000	-0.369226	0.083081	0.018443	-0.549500
Age	0.036847	-0.077221	-0.369226	1.000000	-0.308247	-0.189119	0.096067
SibSp	-0.057527	-0.035322	0.083081	-0.308247	1.000000	0.414838	0.159651
Parch	-0.001652	0.081629	0.018443	-0.189119	0.414838	1.000000	0.216225

```
plt.subplots(figsize=(20,15))
sns.heatmap(corr,annot=True)
```

```
<Axes: >
```


```
dataset.PassengerId.value_counts()
```

```
1      1
599    1
588    1
589    1
590    1
      ..
301    1
302    1
303    1
304    1
891    1
Name: PassengerId, Length: 891, dtype: int64
```

```
dataset.Survived.value_counts()
```

```
0    549
1    342
Name: Survived, dtype: int64
```

```
dataset.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN

```
dataset.    Pclass.value_counts()
```

```
3    491
1    216
2    184
Name: Pclass, dtype: int64
```

3.Handling null values

```
dataset.isnull().any()
```

```
PassengerId    False
Survived       False
Pclass         False
Name           False
Sex            False
Age             True
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin           True
Embarked        True
dtype: bool
```

```
dataset.isnull().sum()
```

```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
```

```
Age           177
SibSp           0
Parch           0
Ticket          0
Fare            0
Cabin         687
Embarked        2
dtype: int64
```

```
dataset["Age"].fillna(dataset["Age"].mean(),inplace=True)
```

```
dataset["Cabin"].fillna(dataset["Cabin"].mode()[0],inplace=True)
```

```
dataset["Embarked"].fillna(dataset["Embarked"].mode()[0],inplace=True)
```

```
dataset.isnull().sum()
```

```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Cabin          0
Embarked       0
dtype: int64
```

```
corr=dataset.corr()
corr
```

```
<ipython-input-21-f22ca9e9dc13>:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version
  corr=dataset.corr()
```

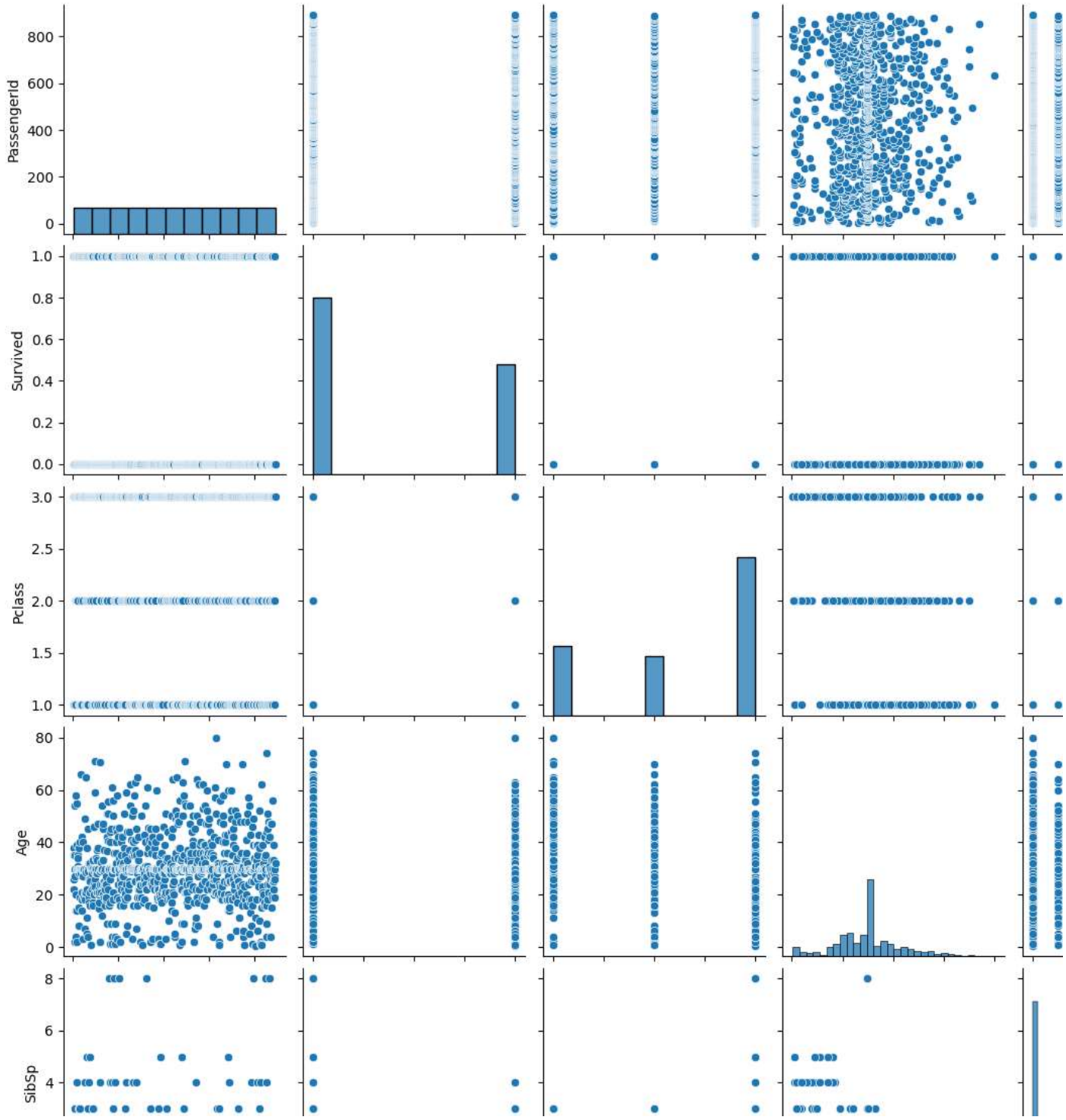
	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
PassengerId	1.000000	-0.005007	-0.035144	0.033207	-0.057527	-0.001652	0.012658
Survived	-0.005007	1.000000	-0.338481	-0.069809	-0.035322	0.081629	0.257307
Pclass	-0.035144	-0.338481	1.000000	-0.331339	0.083081	0.018443	-0.549500
Age	0.033207	-0.069809	-0.331339	1.000000	-0.232625	-0.179191	0.091566
SibSp	-0.057527	-0.035322	0.083081	-0.232625	1.000000	0.414838	0.159651
Parch	-0.001652	0.081629	0.018443	-0.179191	0.414838	1.000000	0.216225
Fare	0.012658	0.257307	-0.549500	0.091566	0.159651	0.216225	1.000000

```
dataset.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	B96 B98
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	B96 B98
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	B96 B98

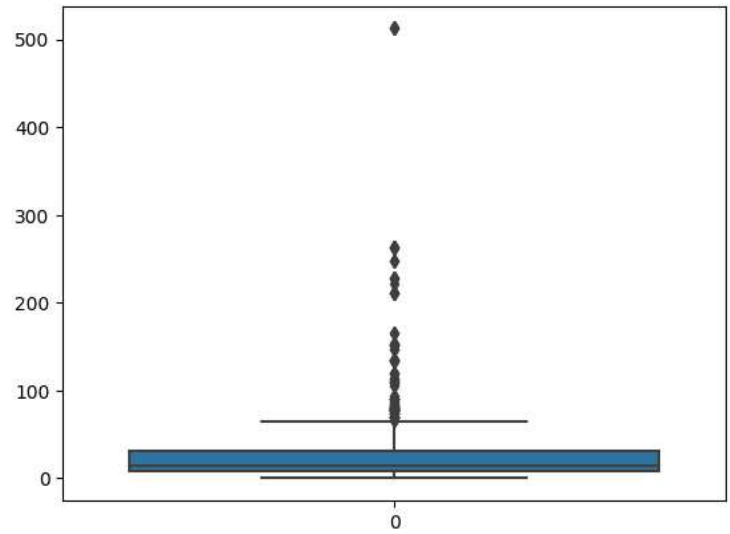
```
sns.pairplot(dataset)
```

```
<seaborn.axisgrid.PairGrid at 0x7b204c200040>
```




```
sns.boxplot(dataset.Fare)
```

```
<Axes: >
```



4.outliers

```
z_scores = np.abs(stats.zscore(dataset['Age']))
max_threshold=3
outliers = dataset['Age'][z_scores > max_threshold]

# Print and visualize the outliers
print("Outliers detected using Z-Score:")
print(outliers)
```

```
Outliers detected using Z-Score:
96     71.0
116    70.5
493    71.0
630    80.0
672    70.0
745    70.0
851    74.0
Name: Age, dtype: float64
```

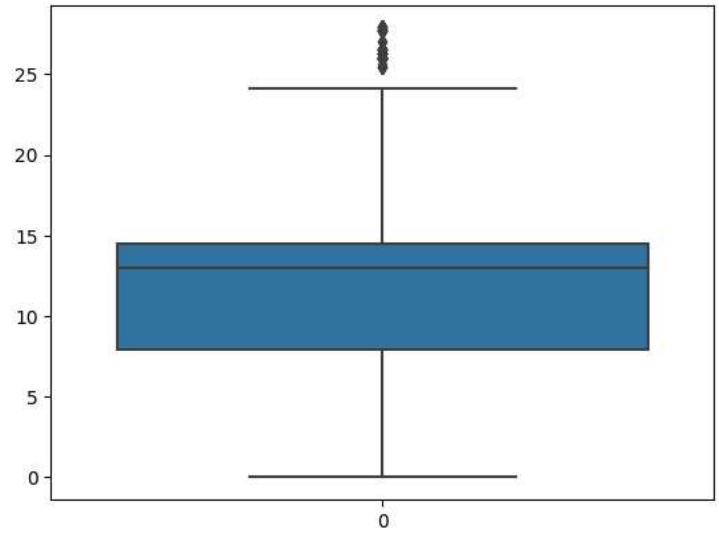
```
z_scores = np.abs(stats.zscore(dataset['Fare']))
max_threshold=3
outliers = dataset['Fare'][z_scores > max_threshold]

# Print and visualize the outliers
print("Outliers detected using Z-Score:")
print(outliers)
```

```
Outliers detected using Z-Score:
27     263.0000
88     263.0000
118    247.5208
258    512.3292
299    247.5208
311    262.3750
341    263.0000
377    211.5000
380    227.5250
438    263.0000
527    221.7792
557    227.5250
679    512.3292
689    211.3375
700    227.5250
716    227.5250
730    211.3375
737    512.3292
742    262.3750
779    211.3375
Name: Fare, dtype: float64
```

```
q1 = dataset.Fare.quantile(0.25)
q3 = dataset.Fare.quantile(0.75)
print(q1)
```

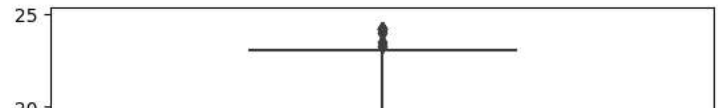
```
print(q3)
upperlimit = q3+1.5*(q3-q1)
upperlimit
lowerlimit = q1-1.5*(q3-q1)
lowerlimit
dataset.median()
dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
sns.boxplot(dataset.Fare)
```

```
7.8958
16.1
<ipython-input-86-20029ddbc2f9>:9: FutureWarning: The default value of numeric_only in DataFrame.median is deprecated. In a future versi
  dataset.median()
<ipython-input-86-20029ddbc2f9>:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-co
  dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
<Axes: >
```



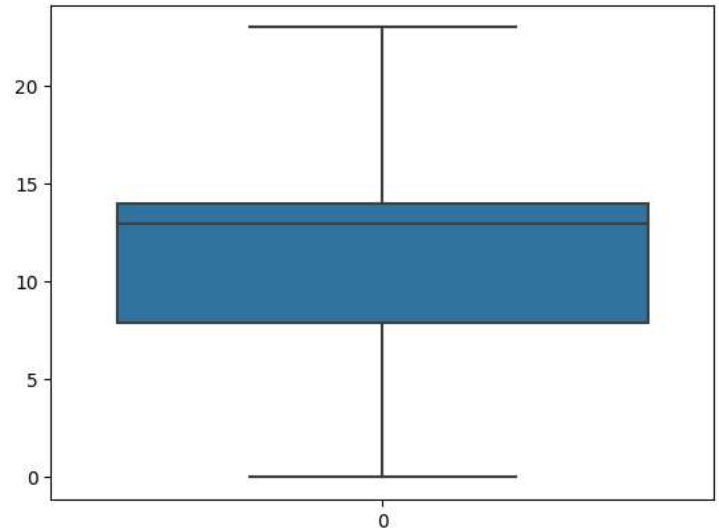

```
q1 = dataset.Fare.quantile(0.25)
q3 = dataset.Fare.quantile(0.75)
print(q1)
print(q3)
upperlimit = q3+1.5*(q3-q1)
upperlimit
lowerlimit = q1-1.5*(q3-q1)
lowerlimit
dataset.median()
dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
sns.boxplot(dataset.Fare)
```

```
7.8958
14.4542
<ipython-input-87-20029ddbc2f9>:9: FutureWarning: The default value of numeric_only in DataFrame.median is deprecated. In a future versi
  dataset.median()
<ipython-input-87-20029ddbc2f9>:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-co
  dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
<Axes: >
```




```
q1 = dataset.Fare.quantile(0.25)
q3 = dataset.Fare.quantile(0.75)
print(q1)
print(q3)
upperlimit = q3+1.5*(q3-q1)
upperlimit
lowerlimit = q1-1.5*(q3-q1)
lowerlimit
dataset.median()
dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
sns.boxplot(dataset.Fare)
```

```
7.8958
14.0
<ipython-input-88-20029ddbc2f9>:9: FutureWarning: The default value of numeric_only in D
  dataset.median()
<ipython-input-88-20029ddbc2f9>:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
  dataset["Fare"]=np.where(dataset["Fare"]>upperlimit,14,dataset['Fare'])
<Axes: >
```




```
dataset=dataset_cleaned
```

```
x=dataset.drop('Survived', axis=1)
y=dataset['Survived']
```

```
x.head()
```

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cab
0	1	3	Braund, Mr. Owen Harris	male	22.000000	1	0	A/5 21171	7.2500	B B

Heikkinen

```
y.head()
```

```
0    0
2    1
3    1
4    0
5    0
Name: Survived, dtype: int64
```

5.Seperate dependent and independent variables

```
#datset.iloc[rows,column]
x=dataset.iloc[:,3:13]
y=dataset.iloc[:,13:14]
```

```
x.head()
```

	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	Braund, Mr. Owen Harris	male	22.000000	1	0	A/5 21171	7.2500	B96 B98	S
2	Heikkinen, Miss. Laina	female	26.000000	0	0	STON/O2. 3101282	7.9250	B96 B98	S
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.000000	1	0	113803	53.1000	C123	S
4	Allen, Mr. William Henry	male	35.000000	0	0	373450	8.0500	B96 B98	S
5	Moran, Mr. James	male	29.699118	0	0	330877	8.4583	B96 B98	Q

```
y.head()
```

0
2
3
4
5

```
dataset.shape
```

```
(775, 12)
```

```
x.shape
```

```
(775, 9)
```

```
y.shape
```

```
(775, 0)
```

6.Encoding

Label encoding on Gender column

```
from sklearn.preprocessing import LabelEncoder
```

```
le=LabelEncoder()
```

```
x["Sex"]=le.fit_transform(x["Sex"])
```

```
x["Sex"]
```

```
0      1
2      0
3      0
4      1
5      1
      ..
886    1
887    0
888    0
889    1
890    1
Name: Sex, Length: 775, dtype: int64
```

```
x["Sex"].value_counts()
```

```
1    531
0    244
Name: Sex, dtype: int64
```

```
x["Sex"].nunique()
```

```
2
```

```
x.head()
```

	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	Braund, Mr. Owen Harris	1	22.000000	1	0	A/5 21171	7.2500	B96 B98	S
2	Heikkinen, Miss. Laina	0	26.000000	0	0	STON/O2. 3101282	7.9250	B96 B98	S
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	0	35.000000	1	0	113803	53.1000	C123	S
4	Allen, Mr. William Henry	1	35.000000	0	0	373450	8.0500	B96 B98	S
5	Moran, Mr. James	1	29.699118	0	0	330877	8.4583	B96 B98	Q

```
x.Sex.value_counts()
```

```
1    531
0    244
Name: Sex, dtype: int64
```

One hot encoding on geography column

```
x.shape
```

```
(775, 9)
```

```
sex=pd.get_dummies(x["Sex"],drop_first=True)
```

```
sex
```

	1
0	1
2	0
3	0

```
#concat
x=pd.concat([x,sex],axis=1)
```

```
x.head()
```

	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	1
0	Braund, Mr. Owen Harris	1	22.000000	1	0	A/5 21171	7.2500	B96 B98	S	1
2	Heikkinen, Miss. Laina	0	26.000000	0	0	STON/O2. 3101282	7.9250	B96 B98	S	0
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	0	35.000000	1	0	113803	53.1000	C123	S	0
4	Allen, Mr. William Henry	1	35.000000	0	0	373450	8.0500	B96 B98	S	1
5	Moran, Mr. James	1	29.699118	0	0	330877	8.4583	B96 B98	Q	1

```
x.drop(["Sex"],axis=1,inplace=True)
```

```
x.head(10)
```

	Name	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	1
0	Braund, Mr. Owen Harris	22.000000	1	0	A/5 21171	7.2500	B96 B98	S	1
2	Heikkinen, Miss. Laina	26.000000	0	0	STON/O2. 3101282	7.9250	B96 B98	S	0
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	35.000000	1	0	113803	53.1000	C123	S	0
4	Allen, Mr. William Henry	35.000000	0	0	373450	8.0500	B96 B98	S	1
5	Moran, Mr. James	29.699118	0	0	330877	8.4583	B96 B98	Q	1
6	McCarthy, Mr. Timothy J	54.000000	0	0	17463	51.8625	E46	S	1
7	Palsson, Master. Gosta Leonard	2.000000	3	1	349909	21.0750	B96 B98	S	1
8	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	27.000000	0	2	347742	11.1333	B96 B98	S	0
9	Nasser, Mrs. Nicholas (Adele Achem)	14.000000	1	0	237736	30.0708	B96 B98	C	0
10	Sandstrom, Miss. Marguerite Rut	4.000000	1	1	PP 9549	16.7000	G6	S	0

```
x.shape
```

```
(775, 9)
```

7.splitting into training and testing set

```
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,random_state=0)
```

```
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(542, 9)
(233, 9)
(542, 0)
(233, 0)
```

```
a=[1,2,3,4,5,6]
b=[1,0,1,5,6,3]

for i in range(5):
    a_train,a_test,b_train,b_test=train_test_split(a,b,test_size=0.3,random_state=100)
```

```
    print("with random state",a_train)
```

```
 with random state [5, 4, 6, 1]
 with random state [5, 4, 6, 1]
 with random state [5, 4, 6, 1]
 with random state [5, 4, 6, 1]
 with random state [5, 4, 6, 1]
```

```
a=[1,2,3,4,5,6]
b=[1,0,1,5,6,3]

for i in range(5):
    a_train,a_test,b_train,b_test=train_test_split(a,b,test_size=0.3)
    print("without random state",a_train)
```

```
 without random state [6, 2, 3, 4]
 without random state [2, 4, 6, 3]
 without random state [2, 6, 4, 3]
 without random state [2, 6, 1, 5]
 without random state [6, 4, 5, 1]
```

8.Feature Scaling

```
scale = StandardScaler()
x[['Age', 'Fare']] = scale.fit_transform(x[['Age', 'Fare']])
```

```
x.head()
```

	Name	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	1
0	Braund, Mr. Owen Harris	-0.556219	1	0	A/5 21171	-0.779117	B96 B98	S	1
2	Heikkinen, Miss. Laina	-0.243027	0	0	STON/O2. 3101282	-0.729373	B96 B98	S	0
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	0.461654	1	0	113803	2.599828	C123	S	0
4	Allen, Mr. William Henry	0.461654	0	0	373450	-0.720161	B96 B98	S	1
5	Moran, Mr. James	0.046606	0	0	330877	-0.690071	B96 B98	Q	1

```
x_train
```

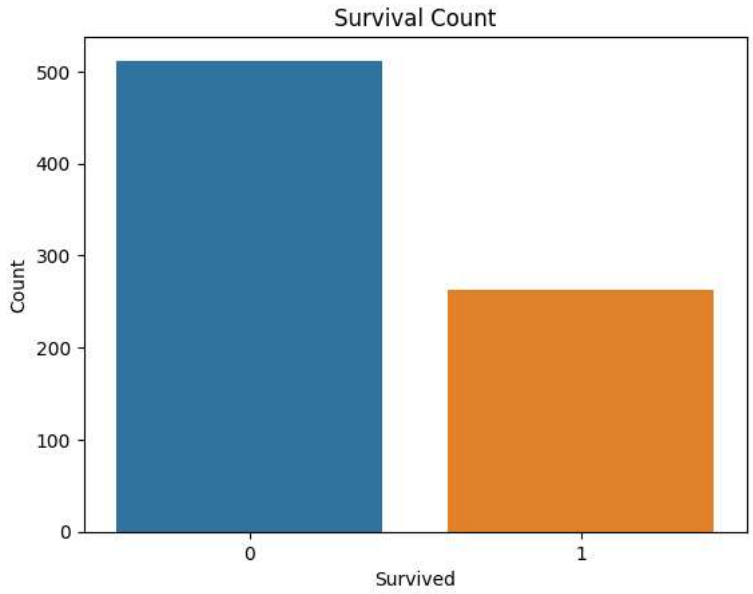
	Name	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	1
654	Hegarty, Miss. Hanora "Nora"	18.000000	0	0	365226	6.7500	B96 B98	Q	0
38	Vander Planke, Miss. Augusta Maria	18.000000	2	0	345764	18.0000	B96 B98	S	0
646	Cor, Mr. Liudevit	19.000000	0	0	349231	7.8958	B96 B98	S	1
727	Mannion, Miss. Margareth	29.699118	0	0	36866	7.7375	B96 B98	Q	0
887	Graham, Miss. Margaret Edith	19.000000	0	0	112053	30.0000	B42	S	0
...	...	...	...	...	...	...	...	...	...
878	Laleff, Mr. Kristo	29.699118	0	0	349217	7.8958	B96 B98	S	1
211	Cameron, Miss. Clear Annie	35.000000	0	0	F.C.C. 13528	21.0000	B96 B98	S	0
725	Oreskovic, Mr. Luka	20.000000	0	0	315094	8.6625	B96 B98	S	1
643	Foo, Mr. Choong	29.699118	0	0	1601	56.4958	B96 B98	S	1
790	Keane, Mr. Andrew "Andy"	29.699118	0	0	12460	7.7500	B96 B98	Q	1

542 rows × 9 columns

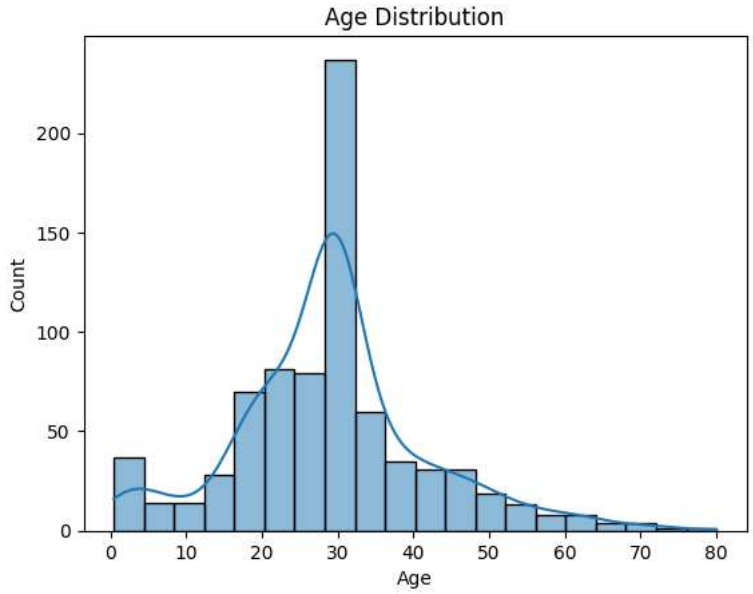
DATA VISUALIZATION

```
sns.countplot(data=dataset, x='Survived')
plt.title('Survival Count')
plt.xlabel('Survived')
```

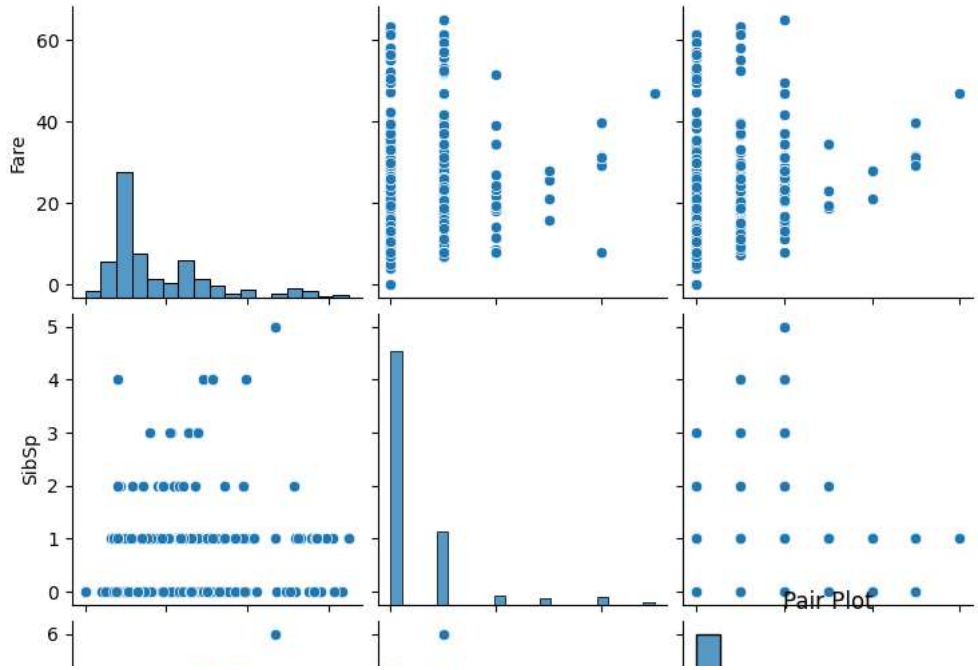
```
plt.ylabel('Count')
plt.show()
```



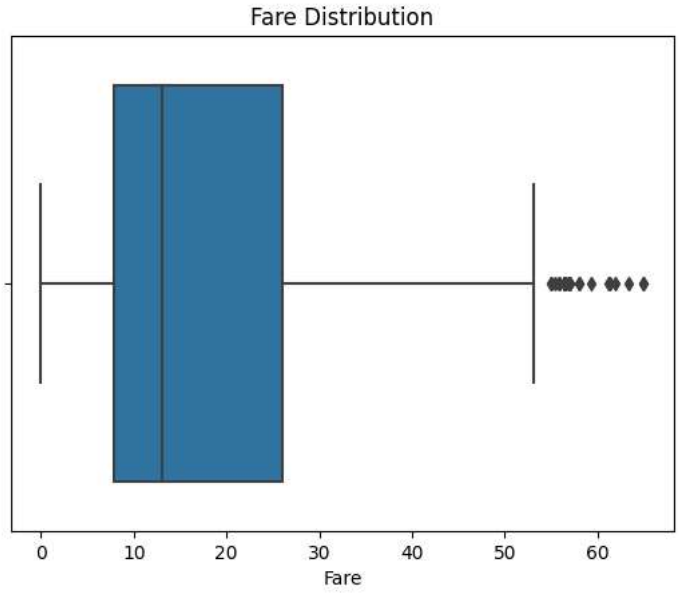

```
sns.histplot(data=dataset, x='Age', bins=20, kde=True)
plt.title('Age Distribution')
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```




```
sns.pairplot(data=dataset[['Fare', 'SibSp', 'Parch']])
plt.title('Pair Plot')
plt.show()
```




```
sns.boxplot(data=dataset, x='Fare')
plt.title('Fare Distribution')
plt.xlabel('Fare')
plt.show()
```




```
corr_matrix = dataset.corr()
sns.heatmap(corr_matrix, annot=True,cmap='coolwarm')
plt.title('Correlation Heatmap')
plt.show()
```