Vellore Institute of Technology

School of Computer Science and Engineering

M.tech Data Science

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Date: 22-05-2023

ADS Assignment -2

1. Importing all the required Libraries:

In [2]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from scipy.stats import skew
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import StandardScaler, OneHotEncoder
```

2. Loading the Dataset

In [9]:
```
Titanic = pd.read_csv("titanic.csv")
```

In [10]:
```
int64_col = Titanic.select_dtypes(include = 'int64')
print("Integer Columns: ", int64_col.columns.to_list())
float64_col = Titanic.select_dtypes(include = 'float64')
print("Float Columns : ", float64_col.columns.to_list())
object_col = Titanic.select_dtypes(include = 'object')
print("Object Columns : ", object_col.columns.to_list())
```

```
Integer Columns:  ['survived', 'pclass', 'sibsp', 'parch']
Float Columns :  ['age', 'fare']
Object Columns :  ['sex', 'embarked', 'class', 'who', 'deck', 'embark_town', 'alive
']
```

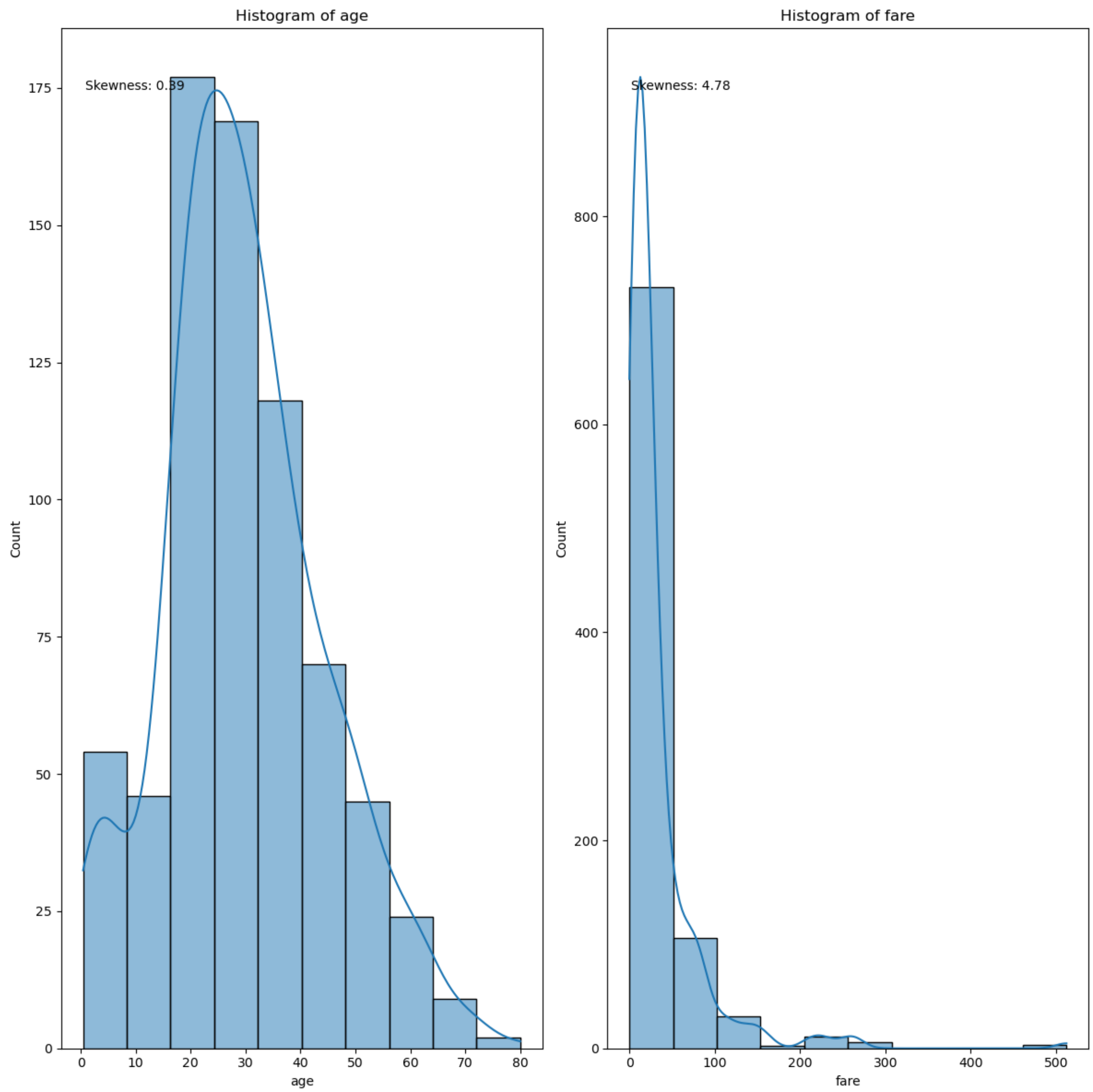
3. Performing the visualisations:

Univariate Analysis :

```
Histogram
Pie Chart
```

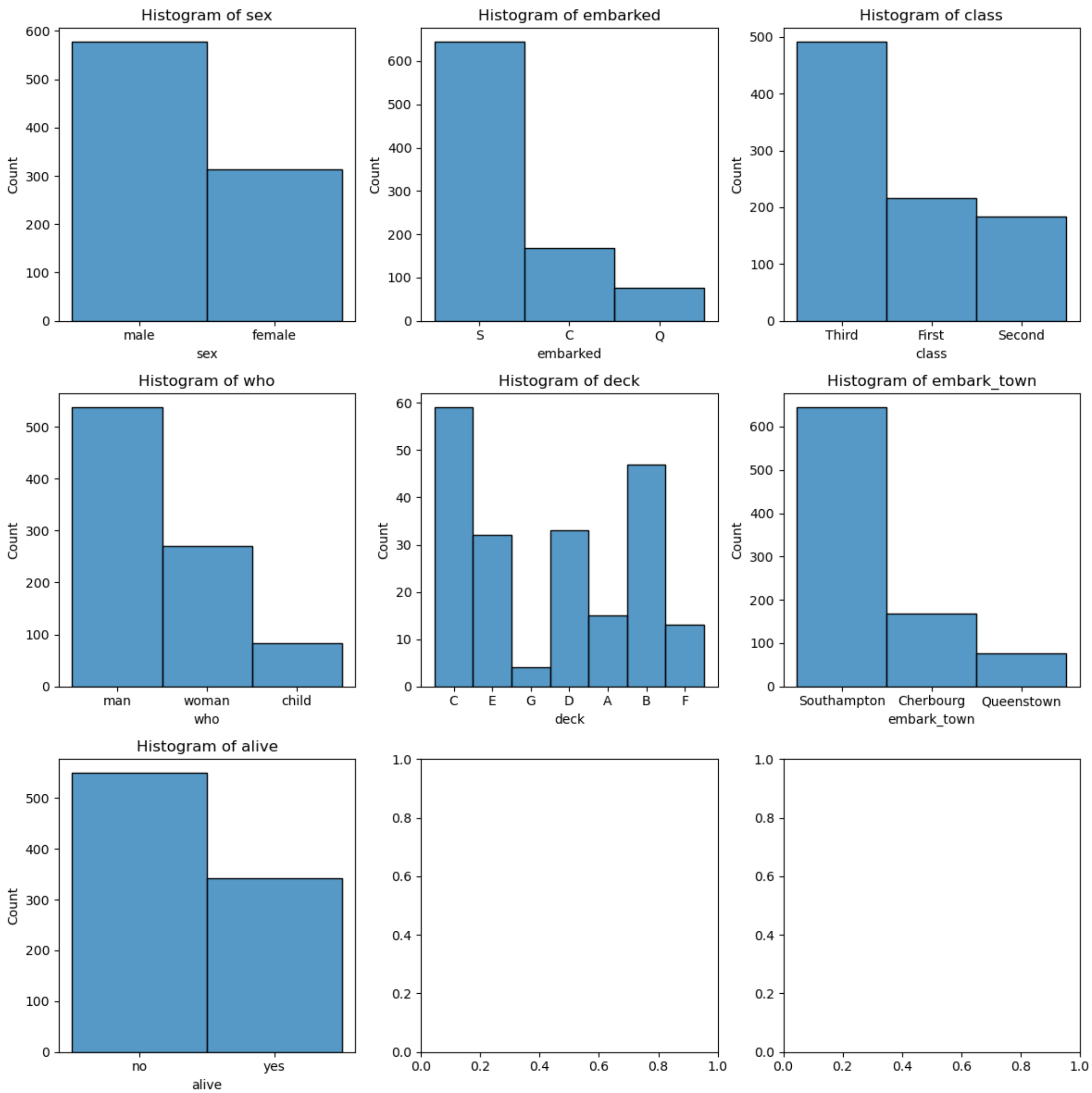
Histogram

In [11]:
```
num_plots = len(float64_col)
num_rows = 1
num_cols = 2

fig, axes = plt.subplots(num_rows, num_cols, figsize=(12, 12))
axes = axes.flatten()

for i, column in enumerate(float64_col):
    if i < num_rows * num_cols:
        ax = axes[i]
        sns.histplot(data=Titanic, x=column, bins=10, stat='count', ax=ax, kde =Tru
        ax.set_xlabel(column)
        ax.set_ylabel('Count')
        ax.set_title(f'Histogram of {column}')
        skewness = skew(Titanic[column].dropna())
        skewness_text = f'Skewness: {skewness:.2f}'
        ax.text(0.05, 0.95, skewness_text, transform=ax.transAxes, fontsize=10, ver
    else:
        break
fig.tight_layout()
plt.show()
```



In [12]:

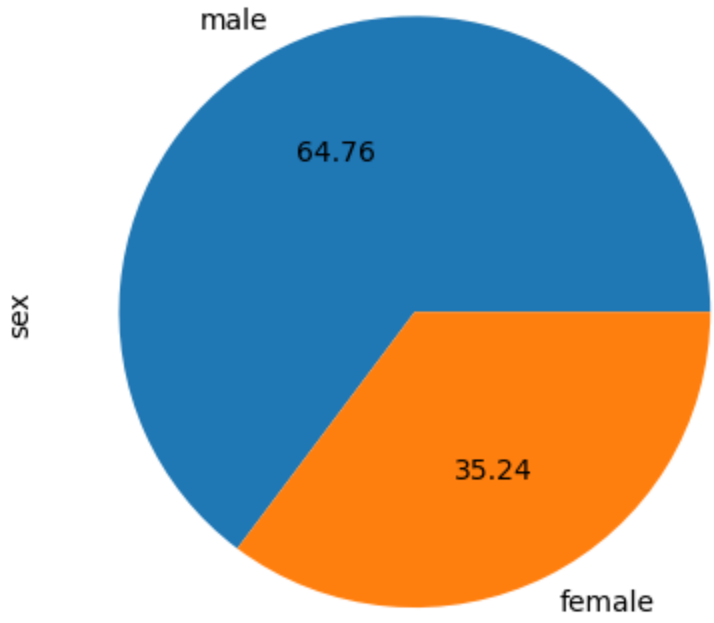
```
num_plots = len(object_col)
num_rows = 3
num_cols = 3
fig, axes = plt.subplots(num_rows, num_cols, figsize=(12, 12))
axes = axes.flatten()
for i, column in enumerate(object_col):
    if i < num_rows * num_cols:
        ax = axes[i]
        sns.histplot(data=Titanic, x=column, bins=10, stat='count', ax=ax)
        ax.set_xlabel(column)
        ax.set_ylabel('Count')
        ax.set_title(f'Histogram of {column}')
    else:
        break
fig.tight_layout()
plt.show()
```



Pie chart

In [13]:
```
Titanic["sex"].value_counts().plot(kind='pie',autopct="%.2f")
```

Out[13]:
```
<Axes: ylabel='sex'>
```



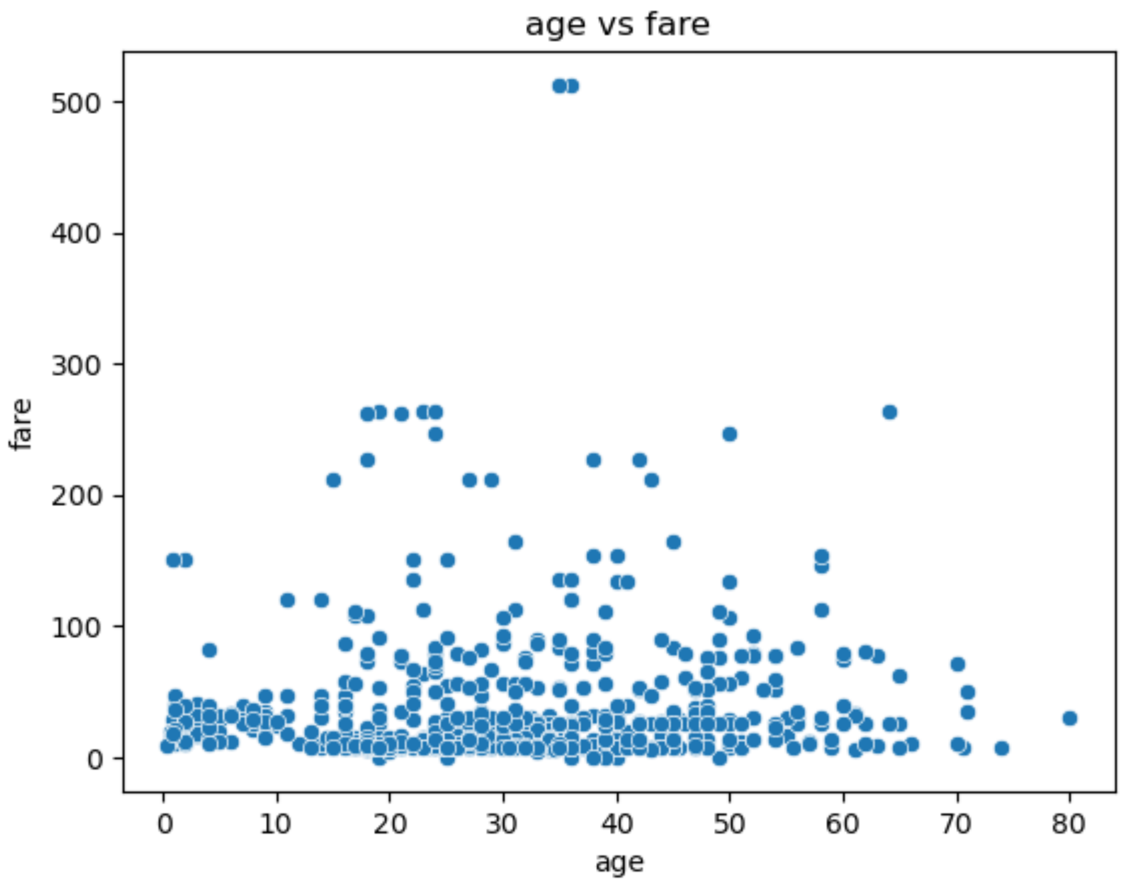
Bivariate Analysis:

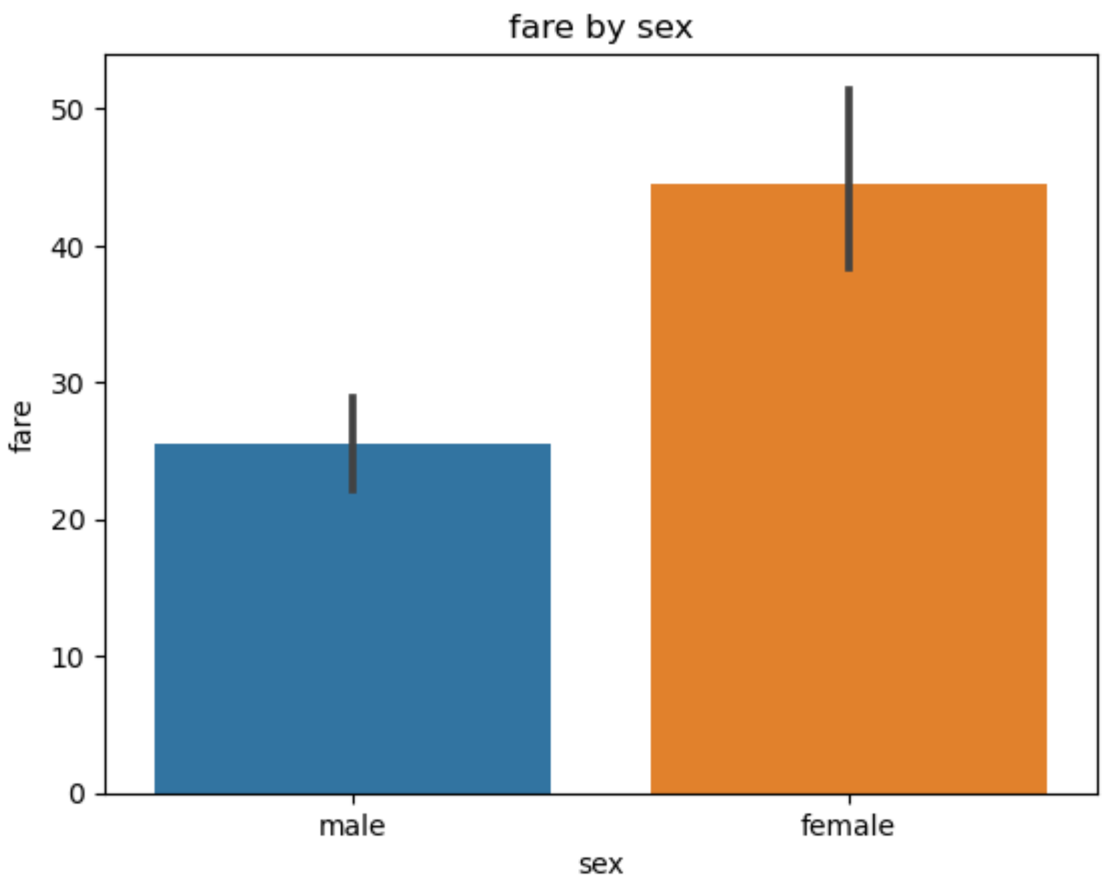
```
Scatter plot
Bar plot
```

Scatter plot and bar plot

In [14]:

```
variable1 = 'age'
variable2 = 'fare'
variable3 = 'sex'

# Scatter plot of age vs fare
sns.scatterplot(data=Titanic, x=variable1, y=variable2)
plt.xlabel(variable1)
plt.ylabel(variable2)
plt.title(f'{variable1} vs {variable2}')
plt.show()

# Bar plot of sex vs fare
sns.barplot(data=Titanic, x=variable3, y=variable2)
plt.xlabel(variable3)
plt.ylabel(variable2)
plt.title(f'{variable2} by {variable3}')
plt.show()
```


age vs fare
fare
0
100
200
300
400
500
0
10
20
30
40
50
60
70
80
age

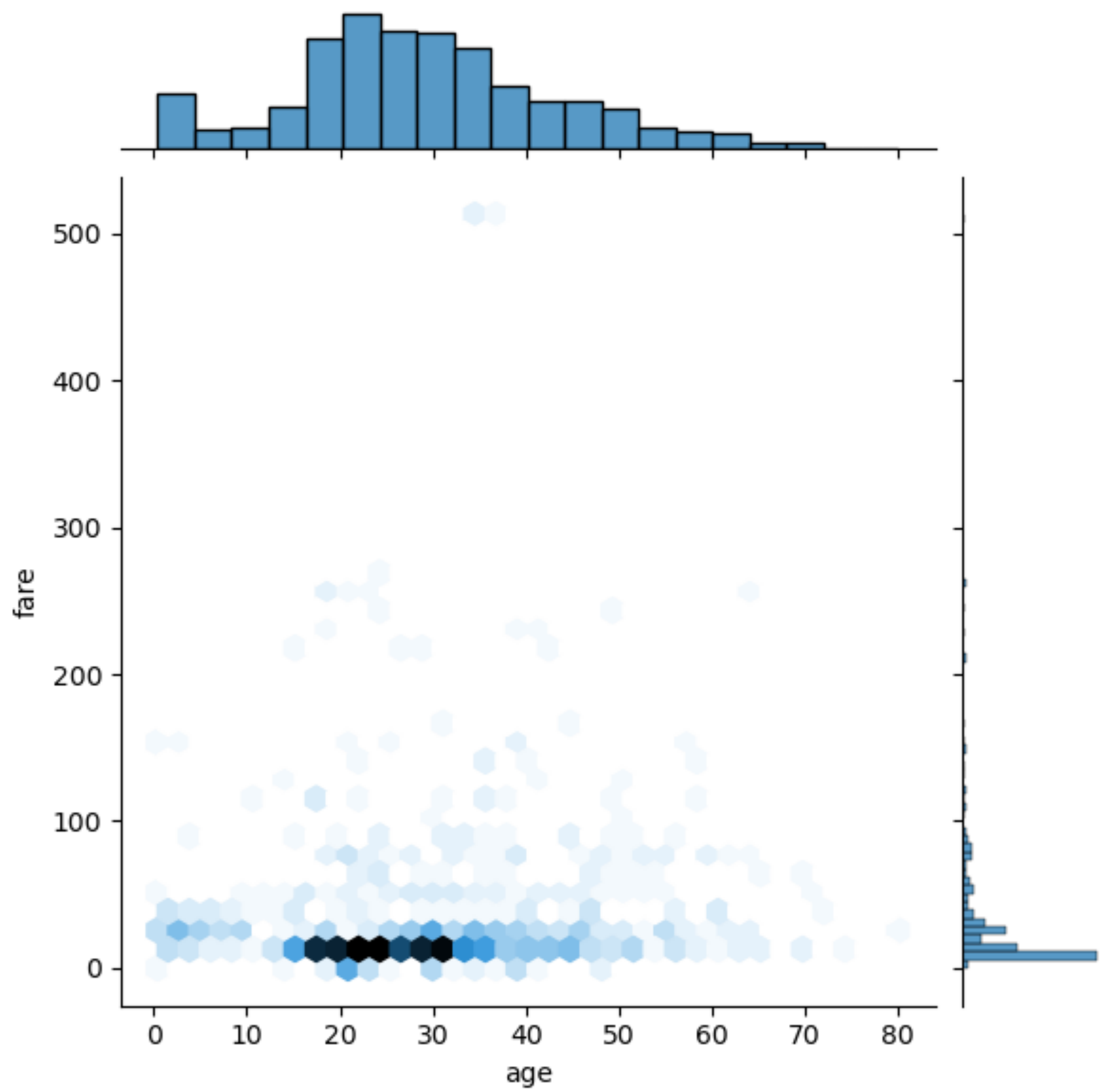

fare by sex
fare
0
10
20
30
40
50
male
female
sex

Multivariate Analysis:

1. Joint Plot:
2. Catplot:
3. PairPlot:
4. Heatmap:

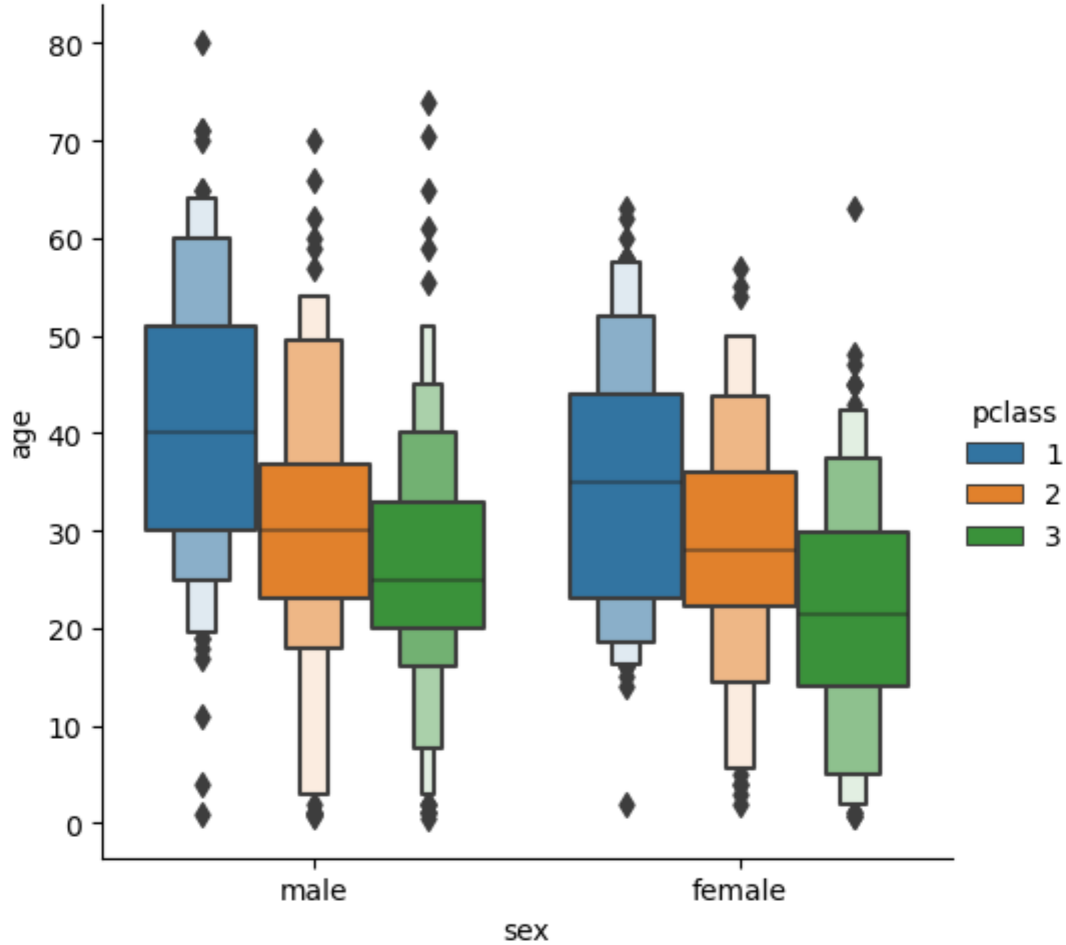
In [15]:
```
#Joint plot
sns.jointplot(x='age', y='fare', data = Titanic, kind='hex')
```

Out[15]: <seaborn.axisgrid.JointGrid at 0x1a24cef72e0>



In [16]:
```
#catplot
sns.catplot(x='sex', y='age', data=Titanic, kind='boxen', hue='pclass')
```

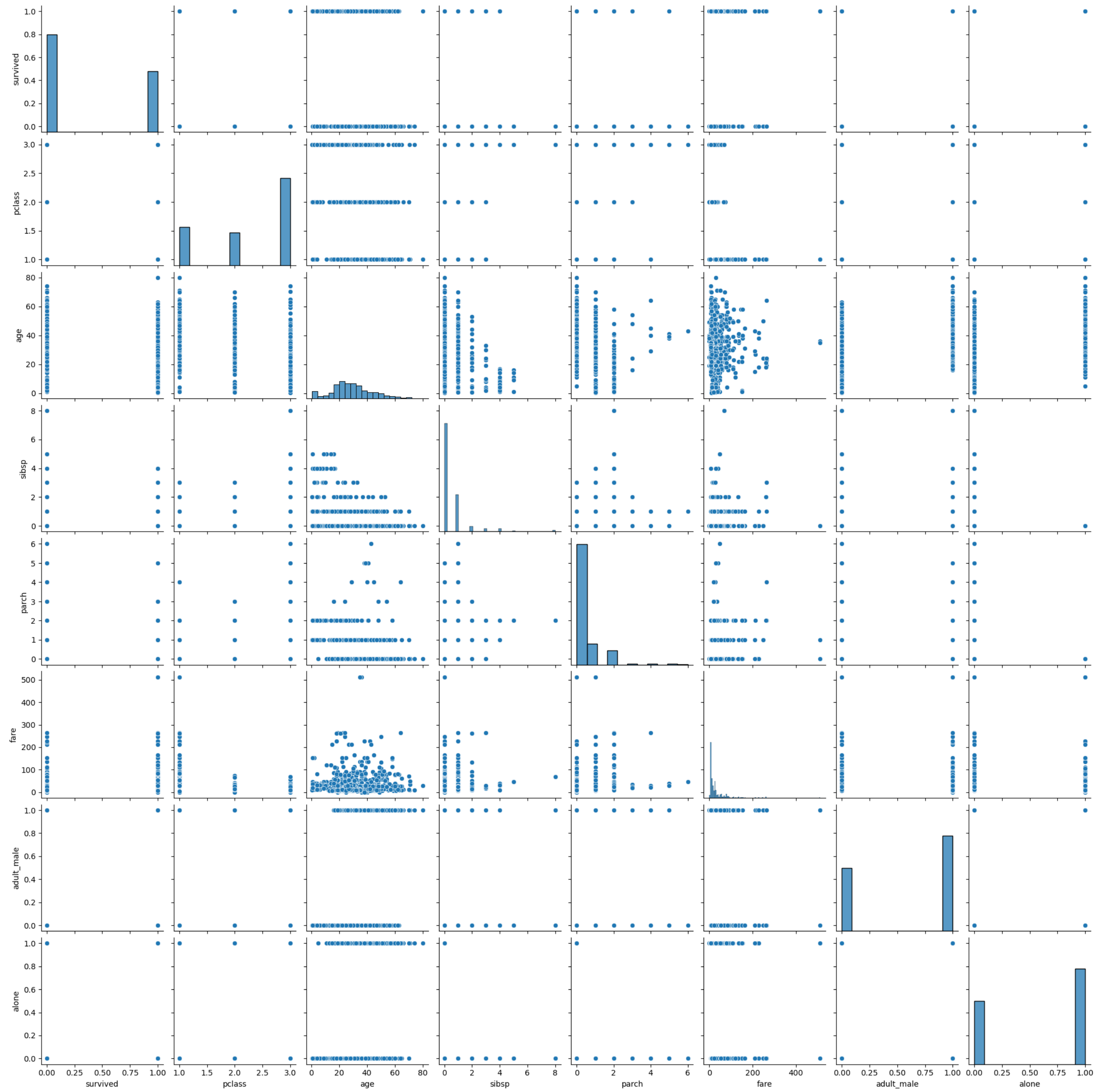
Out[16]: <seaborn.axisgrid.FacetGrid at 0x1a240ef0d90>



In [17]:
```
# Pair plot
sns.pairplot(Titanic)
```

```
<__array_function__ internals>:180: RuntimeWarning: Converting input from bool to
<class 'numpy.uint8'> for compatibility.
<__array_function__ internals>:180: RuntimeWarning: Converting input from bool to
<class 'numpy.uint8'> for compatibility.
```

Out[17]:
```
<seaborn.axisgrid.PairGrid at 0x1a24f704d90>
```



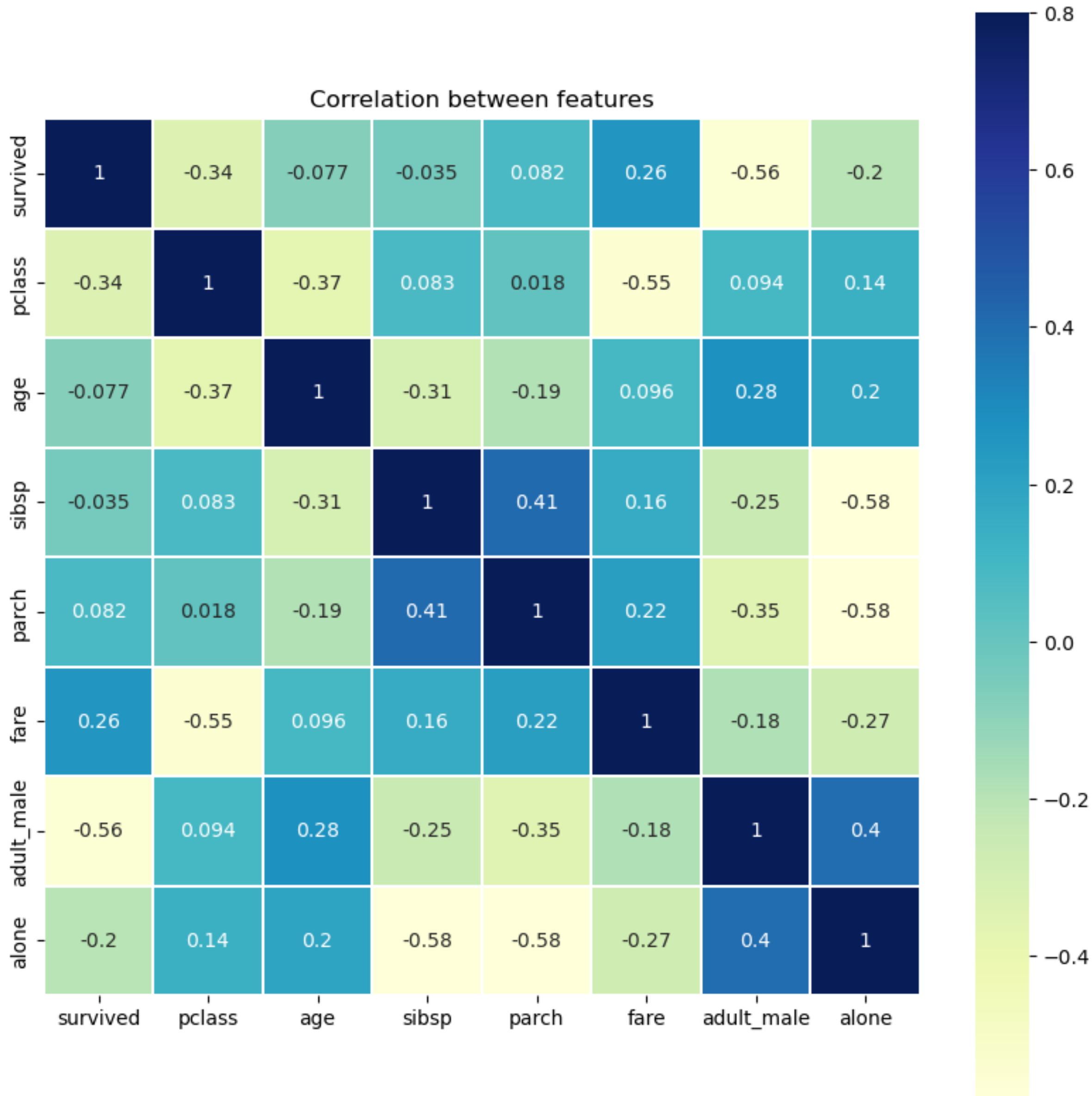
In [18]:

```python
# heat plot
corr=Titanic.corr()#["Survived"]
plt.figure(figsize=(10, 10))

sns.heatmap(corr, vmax=.8, linewidths=0.01,
            square=True,annot=True,cmap='YlGnBu',linecolor="white")
plt.title('Correlation between features')
```

```
C:\Users\prasa\AppData\Local\Temp\ipykernel_784\2631187640.py:2: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.
  corr=Titanic.corr()#["Survived"]
```

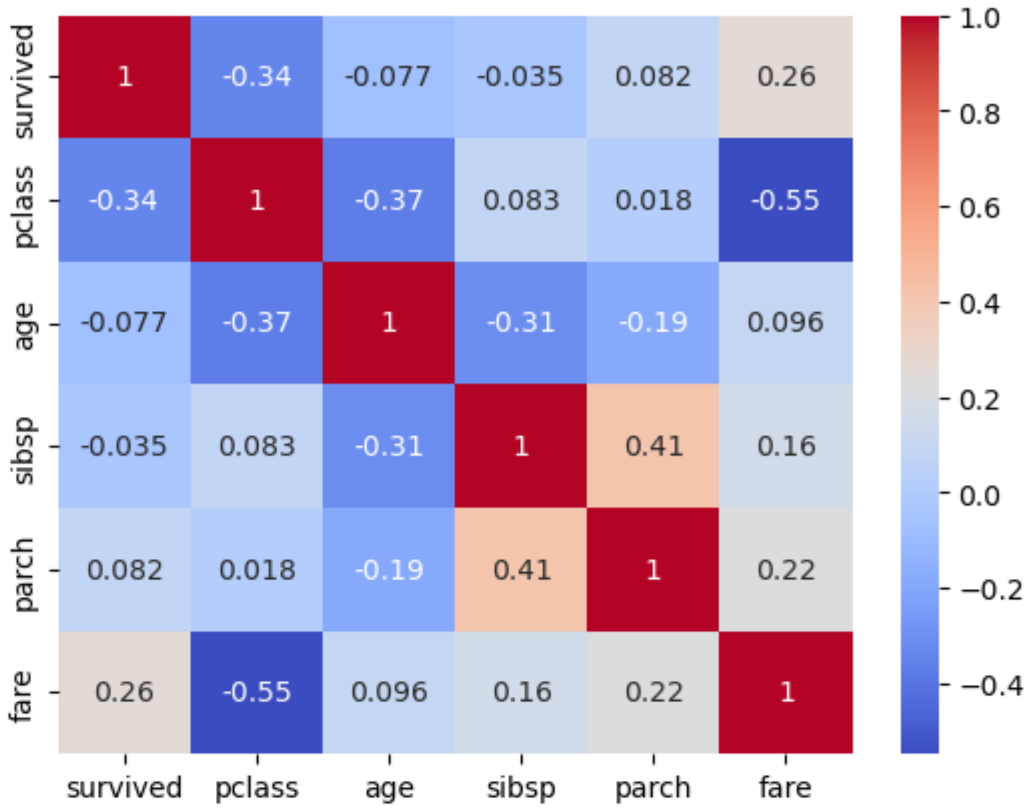
Out[18]:

```
Text(0.5, 1.0, 'Correlation between features')
```



In [19]:
```
numeric_columns = Titanic.select_dtypes(include='number')
correlation_matrix = numeric_columns.corr()
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
```

Out[19]:
```
<Axes: >
```



4. Perform Descriptive statistics:

In [20]:
```
Titanic.describe()
```

Out[20]:

	survived	pclass	age	sibsp	parch	fare
count	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

In [21]:
```
for column in float64_col:
    quantile = Titanic[column].quantile(q=[0.25, 0.75])
    print(f"Quantile values for column '{column}':")
    print(quantile)

    q1 = quantile.iloc[0]
    q3 = quantile.iloc[1]
    IQR = q3 - q1

    print(f"Interquartile Range (IQR) for column '{column}': {IQR}")
    lower_extreme=quantile.iloc[1]-(1.5* IQR)
    print("Lower Extreme : ", lower_extreme)
    upper_extreme=quantile.iloc[0]+(1.5*IQR)
    print("Upper Extreme : ", upper_extreme,"\n")
for column in int64_col:
    quantile = Titanic[column].quantile(q=[0.25, 0.75])
    print(f"Quantile values for column '{column}':")
    print(quantile)

    q1 = quantile.iloc[0]
    q3 = quantile.iloc[1]
    IQR = q3 - q1

    print(f"Interquartile Range (IQR) for column '{column}': {IQR}")
    lower_extreme=quantile.iloc[1]-(1.5* IQR)
    print("Lower Extreme : ", lower_extreme)
    upper_extreme=quantile.iloc[0]+(1.5*IQR)
    print("Upper Extreme : ", upper_extreme,"\n")
```

```
Quantile values for column 'age':
0.25    20.125
0.75    38.000
Name: age, dtype: float64
Interquartile Range (IQR) for column 'age': 17.875
Lower Extreme :  11.1875
Upper Extreme :  46.9375

Quantile values for column 'fare':
0.25     7.9104
0.75    31.0000
Name: fare, dtype: float64
Interquartile Range (IQR) for column 'fare': 23.0896
Lower Extreme :  -3.6343999999999994
Upper Extreme :  42.5448

Quantile values for column 'survived':
0.25    0.0
0.75    1.0
Name: survived, dtype: float64
Interquartile Range (IQR) for column 'survived': 1.0
Lower Extreme :  -0.5
Upper Extreme :  1.5

Quantile values for column 'pclass':
0.25    2.0
0.75    3.0
Name: pclass, dtype: float64
Interquartile Range (IQR) for column 'pclass': 1.0
Lower Extreme :  1.5
Upper Extreme :  3.5

Quantile values for column 'sibsp':
0.25    0.0
0.75    1.0
Name: sibsp, dtype: float64
Interquartile Range (IQR) for column 'sibsp': 1.0
Lower Extreme :  -0.5
Upper Extreme :  1.5

Quantile values for column 'parch':
0.25    0.0
0.75    0.0
Name: parch, dtype: float64
Interquartile Range (IQR) for column 'parch': 0.0
Lower Extreme :  0.0
Upper Extreme :  0.0
```

5. Handling Missing Values:

In [22]:

```
null_counts = Titanic.isnull().sum()
total_counts = Titanic.count()
dict_1 = {'Total Count' : total_counts, "Null Count" : null_counts}
null_table = pd.DataFrame(dict_1)
null_table.index.name = "Column Names"
print(null_table)
```

```
              Total Count  Null Count
Column Names
survived              891           0
pclass                891           0
sex                   891           0
age                   714         177
sibsp                 891           0
parch                 891           0
fare                  891           0
embarked              889           2
class                 891           0
who                   891           0
adult_male            891           0
deck                  203         688
embark_town           889           2
alive                 891           0
alone                 891           0
```

In [23]:
```
#For Embark_town column:
Titanic["embarked"] = Titanic["embarked"].fillna('Cherbourg')
```

In [24]:
```
#For Fare Column:
def fill_missing_fare(df):
    median_fare=df[(df['pclass'] == 3) & (df['embarked'] == 'S')]['fare'].median()
       #print(median_fare)
    df["fare"] = df["fare"].fillna(median_fare)
    return df

Titanic = fill_missing_fare(Titanic)
```

In [25]:
```
Titanic['deck']=Titanic['deck'].fillna(Titanic['deck'].mode()[0])
```

In [26]:
```
Titanic['age']=Titanic['age'].fillna(Titanic['age'].mean())
```

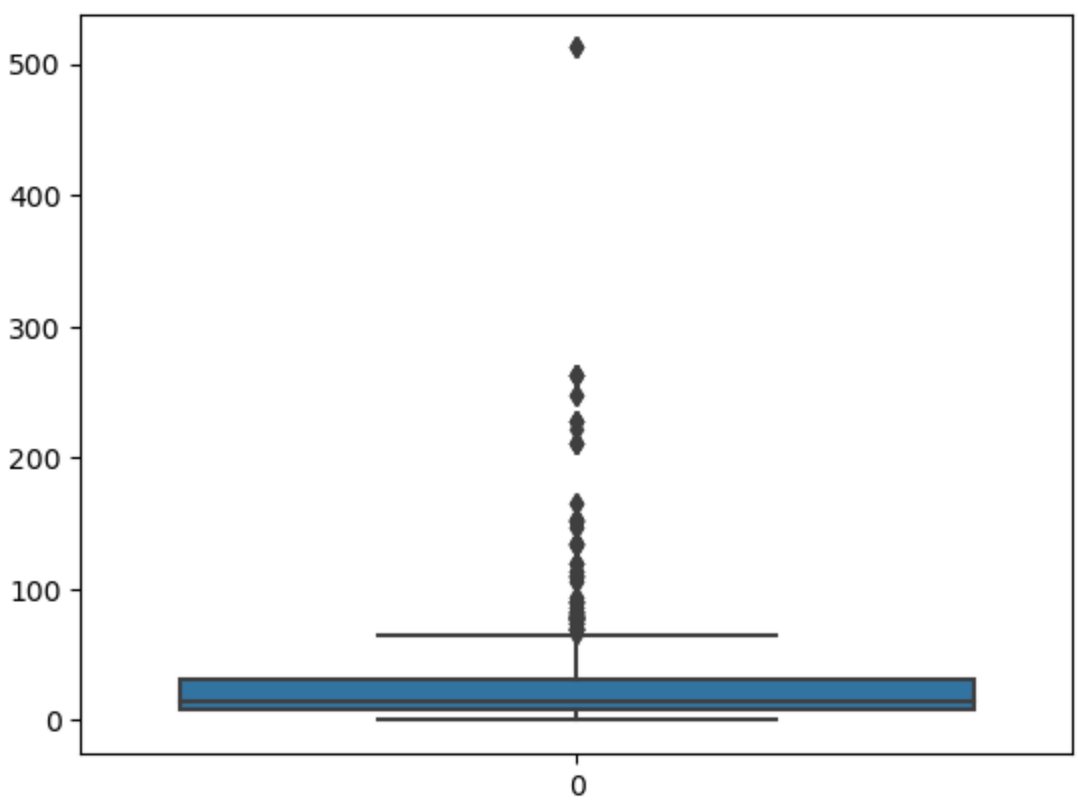
In [27]:
```
null_counts = Titanic.isnull().sum()
total_counts = Titanic.count()
dict_1 = {'Total Count' : total_counts, "Null Count" : null_counts}
null_table = pd.DataFrame(dict_1)
null_table.index.name = "Column Names"
print(null_table)
```

```
              Total Count  Null Count
Column Names
survived              891           0
pclass                891           0
sex                   891           0
age                   891           0
sibsp                 891           0
parch                 891           0
fare                  891           0
embarked              891           0
class                 891           0
who                   891           0
adult_male            891           0
deck                  891           0
embark_town           889           2
alive                 891           0
alone                 891           0
```

6. Find the outliers and replace the outliers:

In [28]:
```
sns.boxplot(Titanic['fare'])
```

Out[28]: <Axes: >



In [29]:
```
#seeing outlier rows
Q1 = Titanic['fare'].quantile(0.25)
Q3 = Titanic['fare'].quantile(0.75)
IQR = Q3 - Q1
whisker_width = 1.5
Fare_outliers = Titanic[(Titanic['fare'] < Q1 - whisker_width*IQR) | (Titanic['fare
Fare_outliers.head()
```

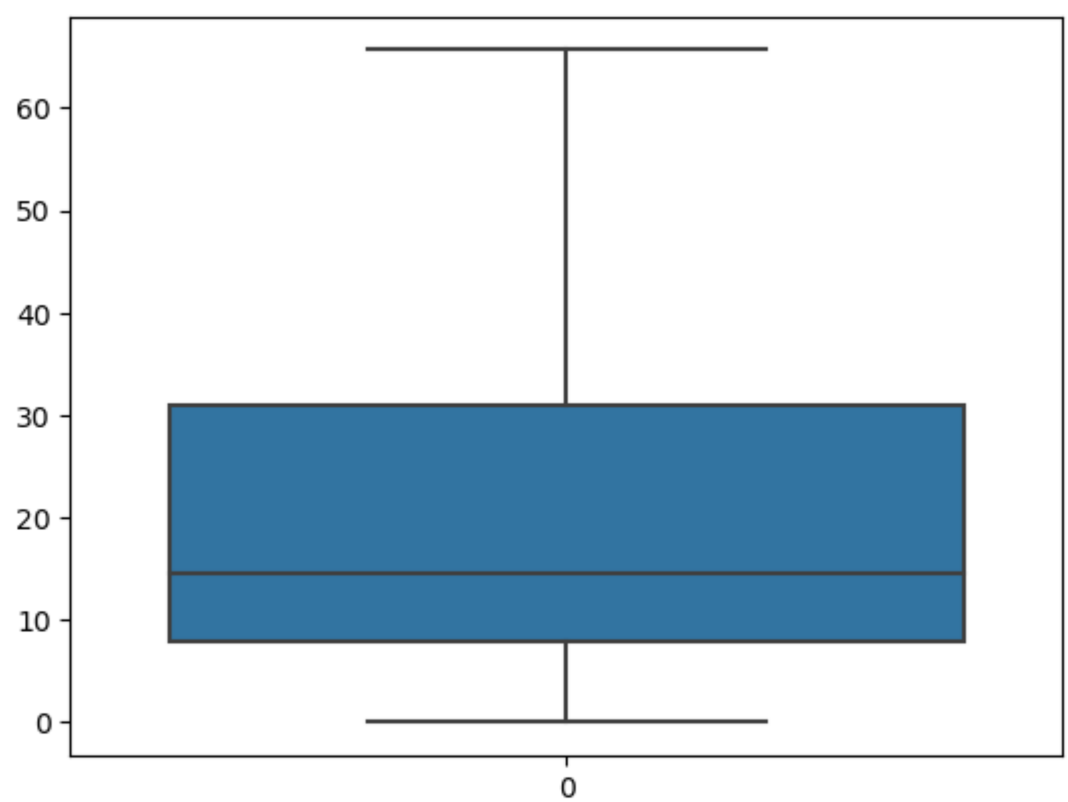
Out[29]:

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class	who	adult_m
1	1	1	female	38.000000	1	0	71.2833	C	First	woman	Fa
27	0	1	male	19.000000	3	2	263.0000	S	First	man	T
31	1	1	female	29.699118	1	0	146.5208	C	First	woman	Fa
34	0	1	male	28.000000	1	0	82.1708	C	First	man	T
52	1	1	female	49.000000	1	0	76.7292	C	First	woman	Fa

In [30]:
```
Q1 = Titanic['fare'].quantile(0.25)
Q3 = Titanic['fare'].quantile(0.75)
IQR = Q3 - Q1
whisker_width = 1.5
lower_whisker = Q1 -(whisker_width*IQR)
upper_whisker = Q3 + (whisker_width*IQR)
Titanic['fare']=np.where(Titanic['fare']>upper_whisker,upper_whisker,np.where(Titan
```

In [31]:
```
sns.boxplot(Titanic['fare'])
```

Out[31]: <Axes: >



7. Check for Categorical columns and perform encoding:

In [32]:
```
#one hot
drop_col = ['age', 'sibsp', 'parch']
data_train_LE = Titanic.drop(drop_col, axis=1)
data_test_LE = Titanic.drop(drop_col, axis=1)
X_train_onehot = Titanic.drop(drop_col, axis=1)
X_test_onehot = Titanic.drop(drop_col, axis=1)
```

In [33]:
```
X_train_onehot.head()
columns = ['sex','embarked','pclass']

for col in columns:
    X_train_onehot = pd.concat([X_train_onehot, pd.get_dummies(X_train_onehot[col],
    X_test_onehot = pd.concat([X_test_onehot, pd.get_dummies(X_test_onehot[col], dr
```

In [34]:
```
X_train_onehot = X_train_onehot.drop(columns, axis=1)
X_test_onehot = X_test_onehot.drop(columns, axis=1)
X_train_onehot.head()
```

Out[34]:

	survived	fare	class	who	adult_male	deck	embark_town	alive	alone	male	Cherbou
0	0	7.2500	Third	man	True	C	Southampton	no	False	1	
1	1	65.6344	First	woman	False	C	Cherbourg	yes	False	0	
2	1	7.9250	Third	woman	False	C	Southampton	yes	True	0	
3	1	53.1000	First	woman	False	C	Southampton	yes	False	0	
4	0	8.0500	Third	man	True	C	Southampton	no	True	1	

In [35]:
```
#label encoder
le = preprocessing.LabelEncoder()
X_train_lab = Titanic.drop(drop_col, axis=1)
X_test_lab = Titanic.drop(drop_col, axis=1)
columns = ['sex', 'embarked']

for col in columns:
    le.fit(Titanic[col])
    X_train_lab[col] = le.transform(X_train_lab[col])
    X_test_lab[col] = le.transform(X_test_lab[col])

X_test_lab.head()
```

Out[35]:

	survived	pclass	sex	fare	embarked	class	who	adult_male	deck	embark_town	alive
0	0	3	1	7.2500	3	Third	man	True	C	Southampton	no
1	1	1	0	65.6344	0	First	woman	False	C	Cherbourg	yes
2	1	3	0	7.9250	3	Third	woman	False	C	Southampton	yes
3	1	1	0	53.1000	3	First	woman	False	C	Southampton	yes
4	0	3	1	8.0500	3	Third	man	True	C	Southampton	no

8. Split the data into dependent and independent variables:

In [36]:
```
X = Titanic.drop('survived', axis=1)  # Independent variables (features)
y = Titanic['survived']  # Dependent variable (target)
```

9. Scale the independent variables:

In [37]:
```
numerical_cols = ['age', 'fare']  # numerical columns
categorical_cols = ['sex', 'embarked']  # categorical columns

preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), numerical_cols),
        ('cat', OneHotEncoder(), categorical_cols)
    ])

# Apply the preprocessing steps
X_scaled = preprocessor.fit_transform(X)
```

10. Split the data into training and testing:

In [38]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_sta
```

In [ ]: