In [327]:

```
from IPython.display import Image, display

display(Image(filename="headerImage.png"))
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

PYTHON ML PROJECT ON TITANIC DATASET:

In [ ]:

Data Dictionary:

In [328]:

```
'''

Variable Definition          Key


survival Survival           0 = No, 1 = Yes
pclass     Ticket class       1 = 1st, 2 = 2nd, 3 = 3rd
sex          Sex
Age          Age in years
sibsp      no. of siblings / spouses aboard the Titanic
parch      no. of parents / children aboard the Titanic
ticket     Ticket number
fare      Passenger fare (in British pounds (£))
cabin      Cabin number
embarked Port of Embarkation   C = Cherbourg, Q = Queenstown, S = Southampton


'''
```

Out[328]:

```
'\n\nVariable\tDefinition\t         Key\n\n\nsurvival\tSurvival\t         0 = No, 1 = Ye
s\npclass\t    Ticket class\t     1 = 1st, 2 = 2nd, 3 = 3rd\nsex\t         Sex\t\nAge\t
Age in years\t\nsibsp\t    no. of siblings / spouses aboard the Titanic\t\nparch\t    no.
of parents / children aboard the Titanic\t\nticket\t    Ticket number\t\nfare\t    Passen
ger fare (in British pounds (£))\ncabin\t    Cabin number\t\nembarked\tPort of Embarkatio
n\t  C = Cherbourg, Q = Queenstown, S = Southampton\n\n\n'
```

Import the dataset:

In [329]:

```
import pandas as pd

df = pd.read_csv("train.csv")
```

Ignore warnings:

In [330]:

```
import warnings
warnings.filterwarnings('ignore')
```

Do some basic inspections:

Check how many rows and columns exist:

In [331]:

```
print("No. of rows in the dataset = ",df.shape[0])
print("No. of columns in the dataset = ",df.shape[1])
```

```
No. of rows in the dataset =  891
No. of columns in the dataset =  12
```

In [332]:

```
df.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
```

In [333]:

```
df.dtypes
```

Out[333]:

```
PassengerId      int64
Survived         int64
Pclass           int64
Name            object
Sex             object
Age            float64
SibSp            int64
Parch            int64
```

```
Ticket          object
Fare           float64
Cabin           object
Embarked        object
dtype: object
```

In [334]:

```
df.isnull().sum()
```

Out[334]:

```
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
```

Handle missing-values:

In [335]:

```
df['Age'].fillna(df['Age'].median(), inplace=True)
df['Embarked'].fillna(df['Embarked'].mode()[0], inplace=True)
df.drop('Cabin', axis=1, inplace=True)
```

In [336]:

```
df.isnull().sum()
```

Out[336]:

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

View the first few rows of the dataset:

In [337]:

```
df.head(5)
```

Out[337]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	S

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	S

Create a new dataframe based on this orignal dataframe upon which we will do Machine-Learning:

In [338]:

```
df_copy = df.copy()
```

In [339]:

```
df_copy['Number of Family Members'] = df_copy['SibSp'] + df_copy['Parch'] + 1
```

Do some further data-cleaning (going to be useful for ML):

In [340]:

```
df_copy.drop(['PassengerId', 'Name', 'Ticket'], axis=1,inplace=True)
df_copy['Sex'] = df_copy['Sex'].map({'male': 0, 'female': 1})
df_copy["Age"] = df_copy["Age"].astype(int)
df_copy["Fare"] = df_copy["Fare"].astype(int)
df_copy["Pclass"] = df_copy["Pclass"].astype(int)

from sklearn.preprocessing import LabelEncoder
label_encoder = LabelEncoder()
df_copy['Embarkation Point Encoded'] = label_encoder.fit_transform(df_copy['Embarked'])
```

In [341]:

```
df.head(3)
```

Out[341]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	S

In [342]:

```
df_copy.head(3)
```

Out[342]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2

In [ ]:

```

```

EDA (Exploratory Data Analysis Questions):

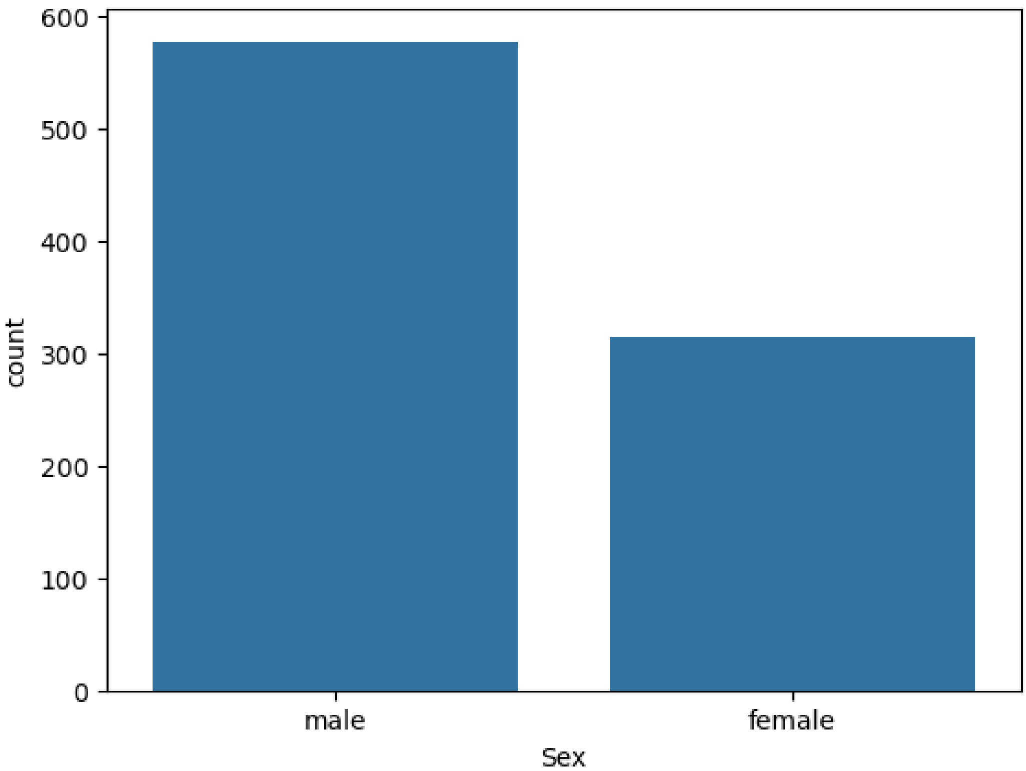
Q1] HOW MANY males AND females boarded the ship:

In [343]:

```
import seaborn as sns
sns.countplot(x="Sex",data=df)
```

Out[343]:

```
<Axes: xlabel='Sex', ylabel='count'>
```



In [344]:

```
survivors_by_gender = df.groupby("Sex")["Survived"].count().reset_index(name="No. of sur
vivors")
survivors_by_gender
```

Out[344]:

	Sex	No. of survivors
0	female	314
1	male	577

In [345]:

```
survivors_by_gender = df[df["Survived"]==0].groupby("Sex")["Survived"].count().reset_ind
ex(name="No. of passengers who died")
survivors_by_gender
```

Out[345]:

	Sex	No. of passengers who died
0	female	81
1	male	468

CONCLUSIONS AT THIS POINT:

- **Around 80% of females survived the disaster.**
- **55% of males survived the disaster.**

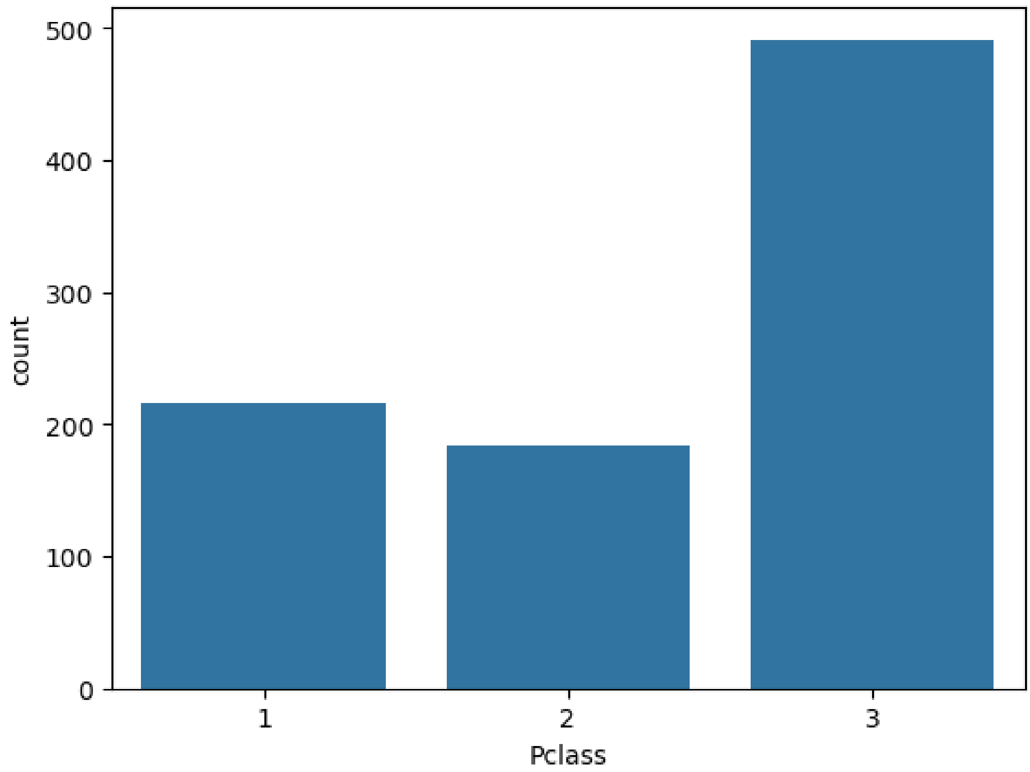
Q2] HOW MANY PEOPLE WERE THERE IN EACH Passenger-class:

In [346]:

```
import seaborn as sns
sns.countplot(x="Pclass",data=df)
```

Out[346]:

<Axes: xlabel='Pclass', ylabel='count'>



Q3] AVERAGE TICKET-PRICES PAID BY EACH Passenger-class:

In [347]:

```
result = df.groupby("Pclass")["Fare"].mean().reset_index()
result
```

Out[347]:

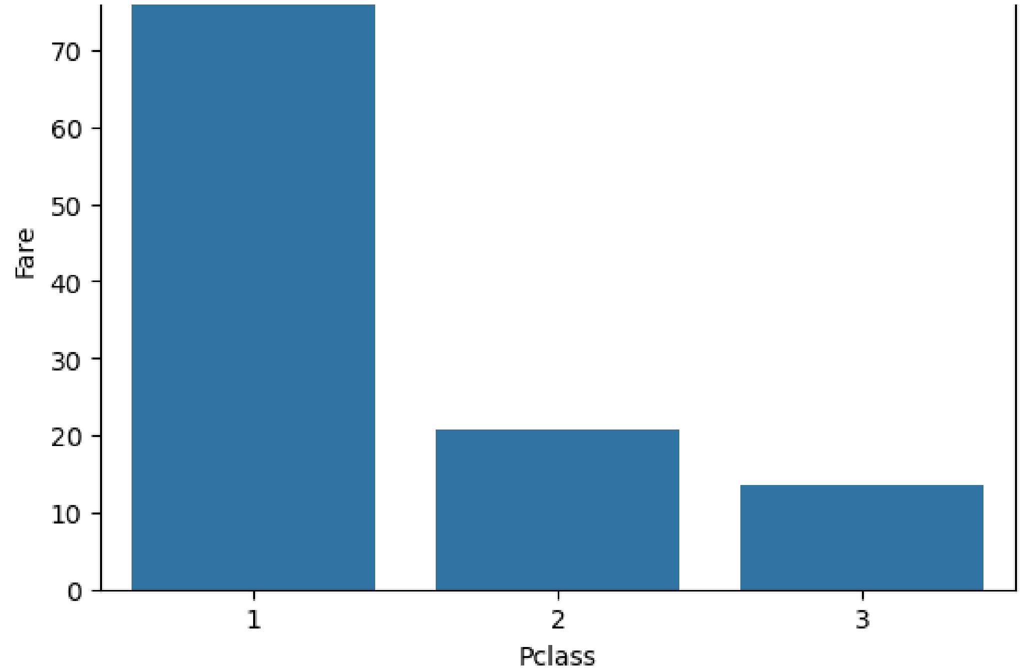
	Pclass	Fare
0	1	84.154687
1	2	20.662183
2	3	13.675550

In [348]:

```
import seaborn as sns
sns.barplot(x="Pclass",y="Fare",data=result)
```

Out[348]:

<Axes: xlabel='Pclass', ylabel='Fare'>



Q4] HOW MANY PEOPLE SURVIVED IN EACH Passenger-class AND HOW MANY DID NOT SURVIVE:

In [349]:

```
result = df["Pclass"].value_counts().reset_index(name="Total no. of Passengers in the cla
ss")
result
```

Out[349]:

	Pclass	Total no. of Passengers in the class
0	3	491
1	1	216
2	2	184

In [350]:

```
result = result.sort_values(by="Pclass")
result
```

Out[350]:

	Pclass	Total no. of Passengers in the class
1	1	216
2	2	184
0	3	491

In [351]:

```
result = result.sort_values(by="Pclass").reset_index(drop=True)
result = df[df["Survived"]==1].groupby("Pclass")["Survived"].count().reset_index(name="T
otal no. of survivors")
result
```

Out[351]:

	Pclass	Total no. of survivors
0	1	136

	Pclass	Total no. of survivors
0	1	136
1	2	87
2	3	119

In [ ]:

```

```

In [352]:

```
result = df[df["Survived"]==0].groupby("Pclass")["Survived"].count().reset_index(name="D
id not survive")
result
```

Out[352]:

	Pclass	Did not survive
0	1	80
1	2	97
2	3	372

CONCLUSION TILL HERE:

- **Most people on the ship were from 3rd passenger-class.**
- **People belonging to the 1st passenger-class paid the most fare.**
- **More than 50% of people in 1st passenger-class survived the disaster.**
- **Only 47% passengers in 2nd passenger-class survived the disaster.**
- **Only 24% passengers in 3rd passenger-class survived the disaster.**

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

ML QUESTIONS:

Q1] PREDICTING FARE-AMOUNT BASED ON:

- **Passenger Class**
- **Family Members**
- **Embarkation Point**

In [353]:

```
from sklearn import linear_model

reg = linear_model.LinearRegression()

independent_variables = ["Pclass","Number of Family Members","Embarkation Point Encoded"]
reg.fit(df_copy[independent_variables],df["Fare"])
reg.predict([[3,2,2]])
```

Out[353]:

```
array([6.21894201])
```

In [ ]:

Q2] PREDICTING PASSENGER-AGE BASED ON:

- **Passenger Class**
- **Number of Family Members**
- **Gender**

In [354]:

```
from sklearn import linear_model

reg = linear_model.LinearRegression()

independent_variables = ["Pclass","Number of Family Members","Sex"]
reg.fit(df_copy[independent_variables],df["Age"])
reg.predict([[3,2,0]])
```

Out[354]:

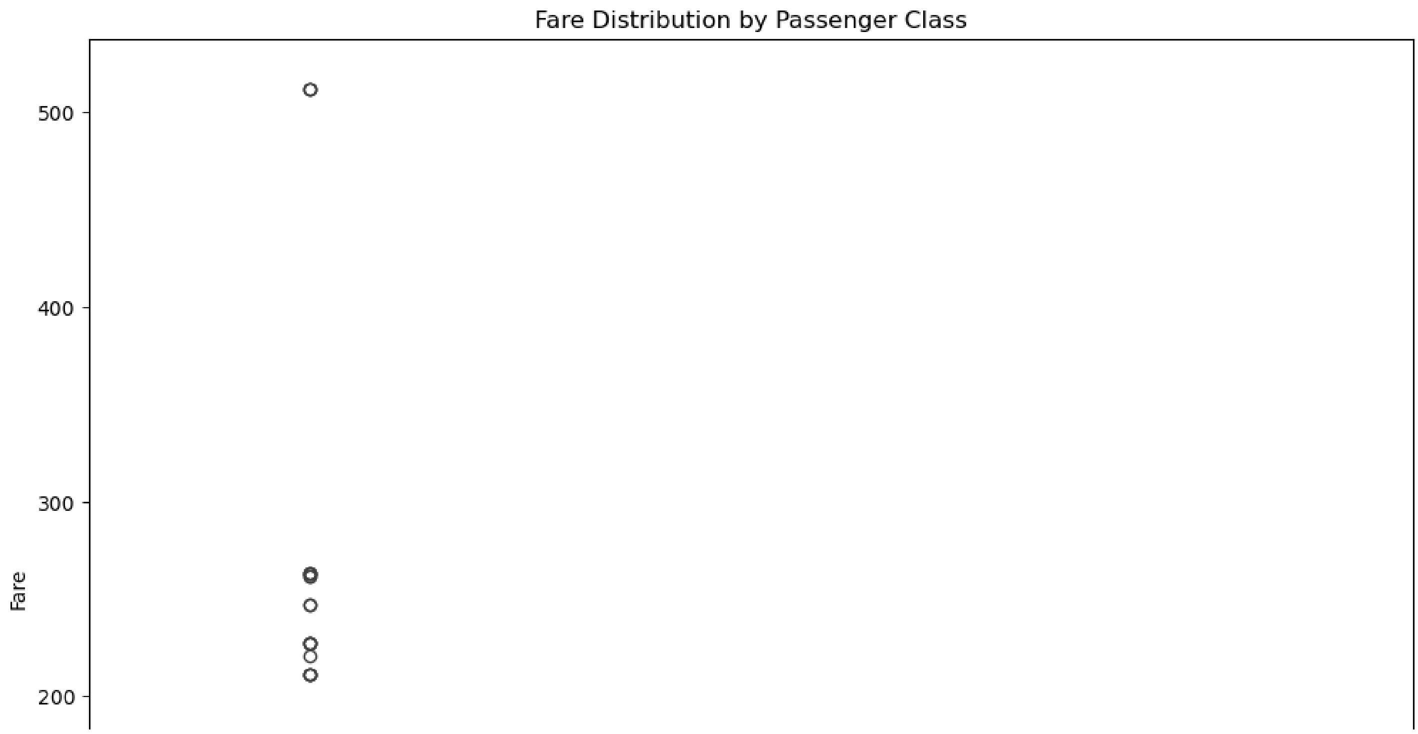
```
array([26.37839535])
```

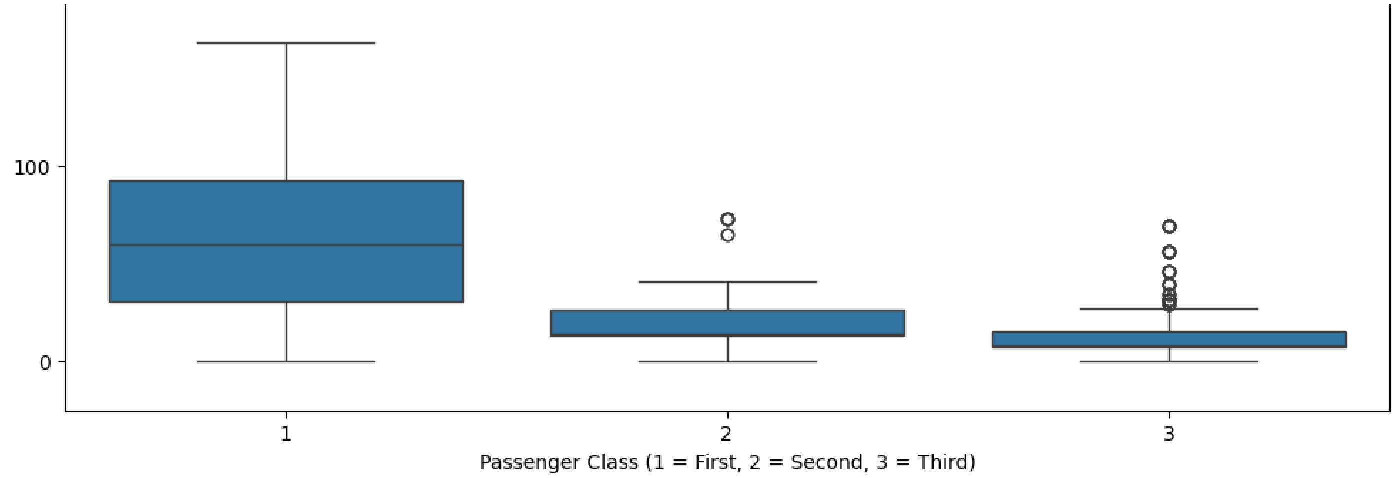
In [ ]:

Q3] RELATIONSHIP BETWEEN FARE AND PASSENGER-CLASS:

In [355]:

```
import matplotlib.pyplot as plt
import seaborn as sns

plt.figure(figsize=(12,10))
sns.boxplot(x='Pclass', y='Fare', data=df_copy)
plt.title("Fare Distribution by Passenger Class")
plt.xlabel("Passenger Class (1 = First, 2 = Second, 3 = Third)")
plt.ylabel("Fare")
plt.show()
```





CONCLUSION AT THIS POINT:

- **Passengers belonging to class 1 paid highest fair and in the range of 50 to 100 pounds (approx.)**
- **Passengers belonging to class 2 paid moderate fair and in the range of 20 to 40 pounds (approx.)**
- **Passengers belonging to class 3 paid least fair and in the range of 20 to 30 pounds (approx.)**

In [356]:

```
df_copy.head(10)
```

Out[356]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2
5	0	3	0	28	0	0	8	Q	1	1
6	0	1	0	54	0	0	51	S	1	2
7	0	3	0	2	3	1	21	S	5	2
8	1	3	1	27	0	2	11	S	3	2
9	1	2	1	14	1	0	30	C	2	0

In [ ]:

```

```

Q4] Effect of Family Size on Fare

In [357]:

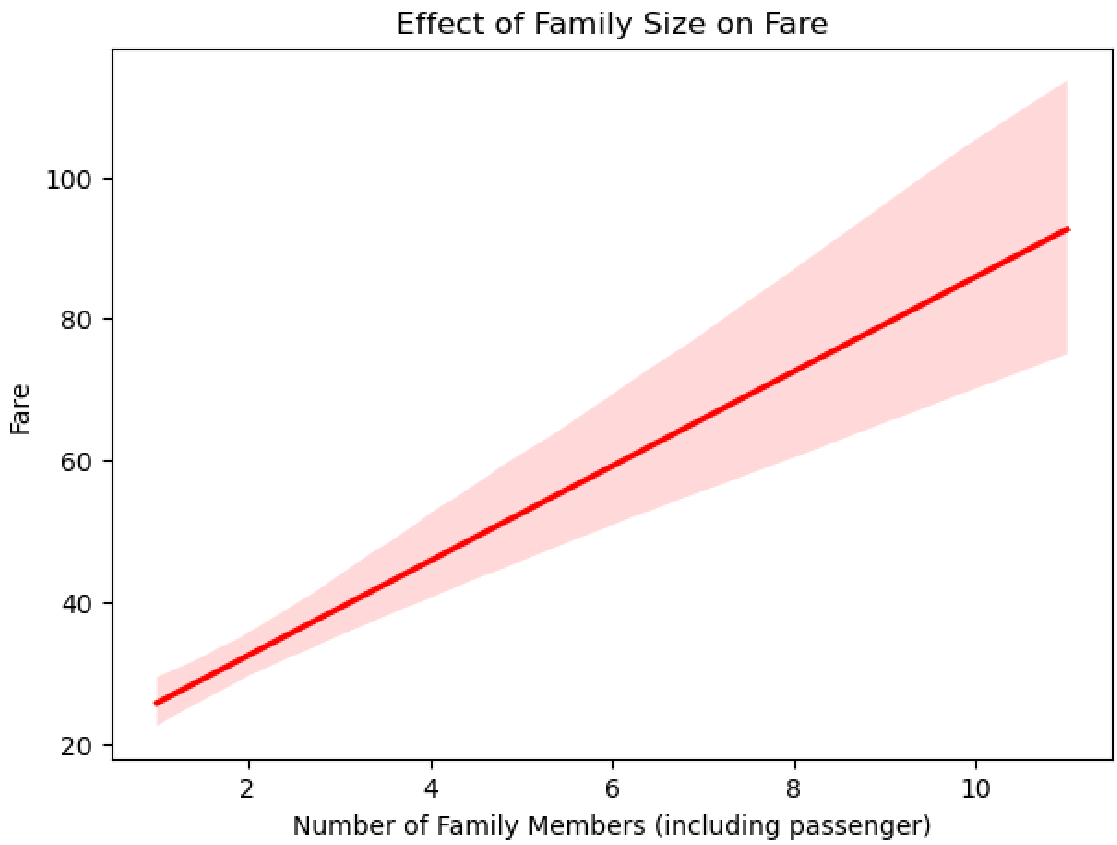
```
from sklearn import linear_model

reg = linear_model.LinearRegression()


reg.fit(df_copy[["Number of Family Members"]],df["Fare"])
reg.predict([[1]])
```

Out[357]:

```
array([26.15448989])
```

In [358]:

```python
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(7,5))
sns.regplot(x='Number of Family Members', y='Fare', data=df_copy, scatter=False, color='
red')
plt.title("Effect of Family Size on Fare")
plt.xlabel("Number of Family Members (including passenger)")
plt.ylabel("Fare")
plt.show()
```



CONCLUSION AT THIS POINT: Ticket Prices increases as the no. of family members increases (for all passenger classes 1 , 2 and 3)

Q5] PREDICTING SURVIVAL BASED ON:

- **Age**
- **Fare**

In [359]:

```python
df_copy.head(10)
```

Out[359]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2
5	0	3	0	28	0	0	8	Q	1	1
6	0	1	0	54	0	0	51	S	1	2
7	0	3	0	2	3	1	21	S	5	2

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
8	1	3	1	27	0	2	11	S	3	2
9	1	2	1	14	1	0	30	C	2	0

In [360]:

```
from sklearn.linear_model import LogisticRegression

reg = linear_model.LogisticRegression()


reg.fit(df_copy[["Age","Fare"]],df["Survived"])
reg.predict([[20,7.25]])
```

Out[360]:

```
array([0])
```

In [361]:

```
from sklearn.linear_model import LogisticRegression

reg = linear_model.LogisticRegression()


reg.fit(df_copy[["Age","Fare"]],df["Survived"])
reg.predict([[54,1030.07]])
```

Out[361]:

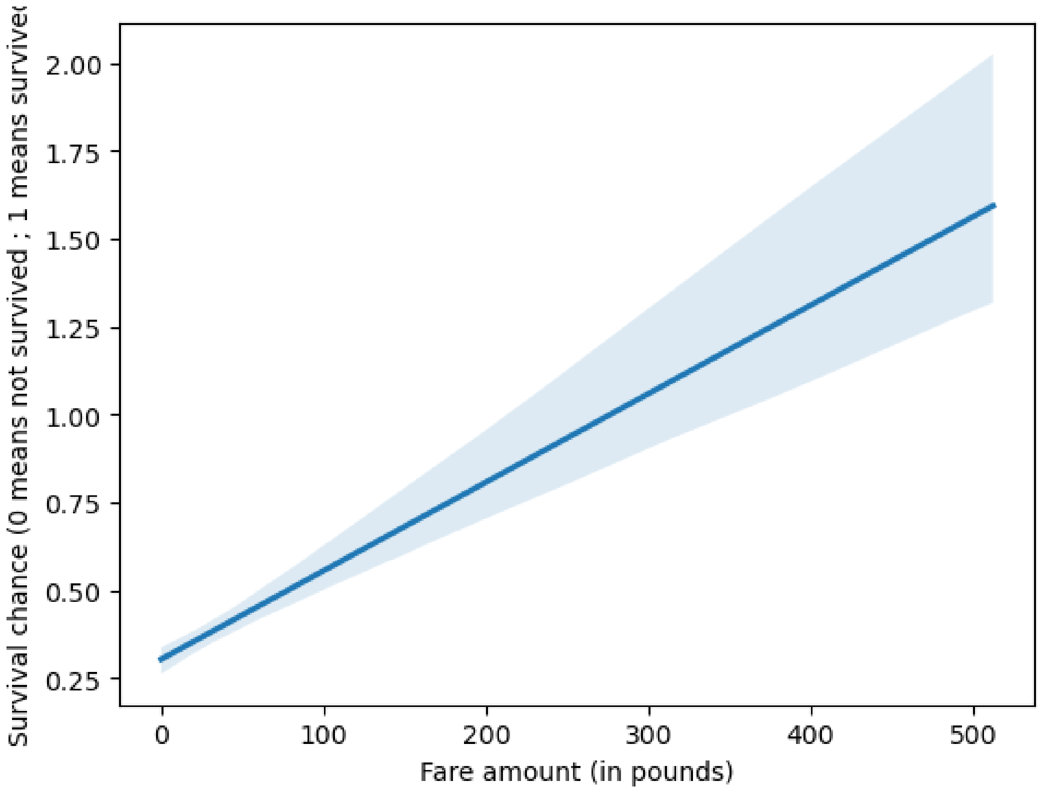
```
array([1])
```

In [362]:

```
import seaborn as sns
import matplotlib.pyplot as plt

sns.regplot(x="Fare",y="Survived",data=df_copy,scatter=False)


plt.xlabel("Fare amount (in pounds)")
plt.ylabel("Survival chance (0 means not survived ; 1 means survived)")
```

Out[362]:

```
Text(0, 0.5, 'Survival chance (0 means not survived ; 1 means survived)')
```

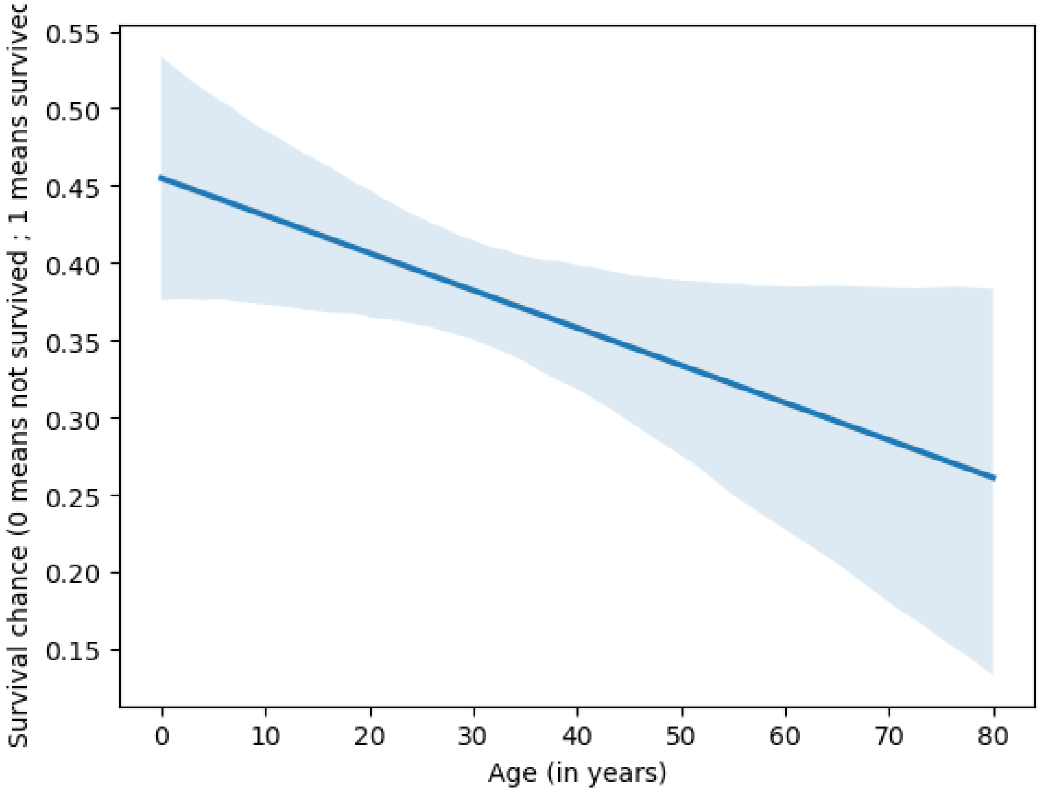


In [363]:

```
import seaborn as sns
import matplotlib.pyplot as plt

sns.regplot(x="Age",y="Survived",data=df_copy,scatter=False)

plt.xlabel("Age (in years)")
plt.ylabel("Survival chance (0 means not survived ; 1 means survived)")
```

Out[363]:

```
Text(0, 0.5, 'Survival chance (0 means not survived ; 1 means survived)')
```



CONCLUSION AT THIS POINT:

- **A 20 year old (male/female) who paid nearly 7 pounds was likely not to survive.**
- **A 50 year old (male/female) who paid nearly 1000 pounds was likely to survive.**
- **People who spent more money on the trip; were more likely to survive.**
- **People who were elderly were more likely to not survive.**

In [ ]:

```

```

CONCLUSION DRAWN FROM THE ENTIRE ANALYSIS (TILL HERE):

- **Passengers in higher classes (1st class) paid substantially higher fares than those in lower classes.**
- **Males in higher classes tended to be older, while females and lower-class passengers were generally younger.**
- **Customers in higher passenger-class pay higher fares**
- **Larger families tended to pay slightly higher total fares, possibly because they booked together or purchased multiple tickets.**
- **Younger passengers and those who paid higher fares (likely first-class passengers) had a higher chance of survival.**

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

USE DECISION-TREE TO PREDICT Passenger-Survival based on :

- **Pclass**
- **Sex**
- **Age**
- **Sibsp (No. of Siblings if any)**
- **Parch (No. of parents / children aboard on Titanic)**
- **Fare**

In [364]:

```
df_copy.head(5)
```

Out[364]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [365]:

```
from sklearn import tree
model = tree.DecisionTreeClassifier()


independent_variables = ["Pclass","Sex","Age","SibSp","Parch","Fare"]
model.fit(df_copy[independent_variables],df_copy["Survived"])
```

Out[365]:

▼
DecisionTreeClassifier
i ?

▶ Parameters

In [366]:

```
#Check the model's accuracy:
model.score(df_copy[independent_variables],df_copy["Survived"])
```

Out[366]:

0.9528619528619529

In [367]:

```
df.head(5)
```

Out[367]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked

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

In [368]:

```
df_copy.head(5)
```

Out[368]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

Now make a prediction for a person with these details:

- Passenger-class : 3
- Gender : Male
- Age: 22
- No. of siblings: 1
- No. of parents and children: 0
- Trip Fare: 7 pounds (approx.)

In [369]:

```
model.predict([[3,0,22.0,1,0,7.25]])
```

Out[369]:

```
array([0])
```

CONCLUSION OF THIS POINT: PASSENGER WITH THESE DETAILS WAS LIKELY TO SURVIVE

- Passenger-class : 3
- Gender : Male
- Age: 22
- No. of siblings: 1
- No. of parents and children: 0
- Trip Fare: 7 pounds (approx.)

In [ ]:

```

```

In [370]:

```
df_copy.head(5)
```

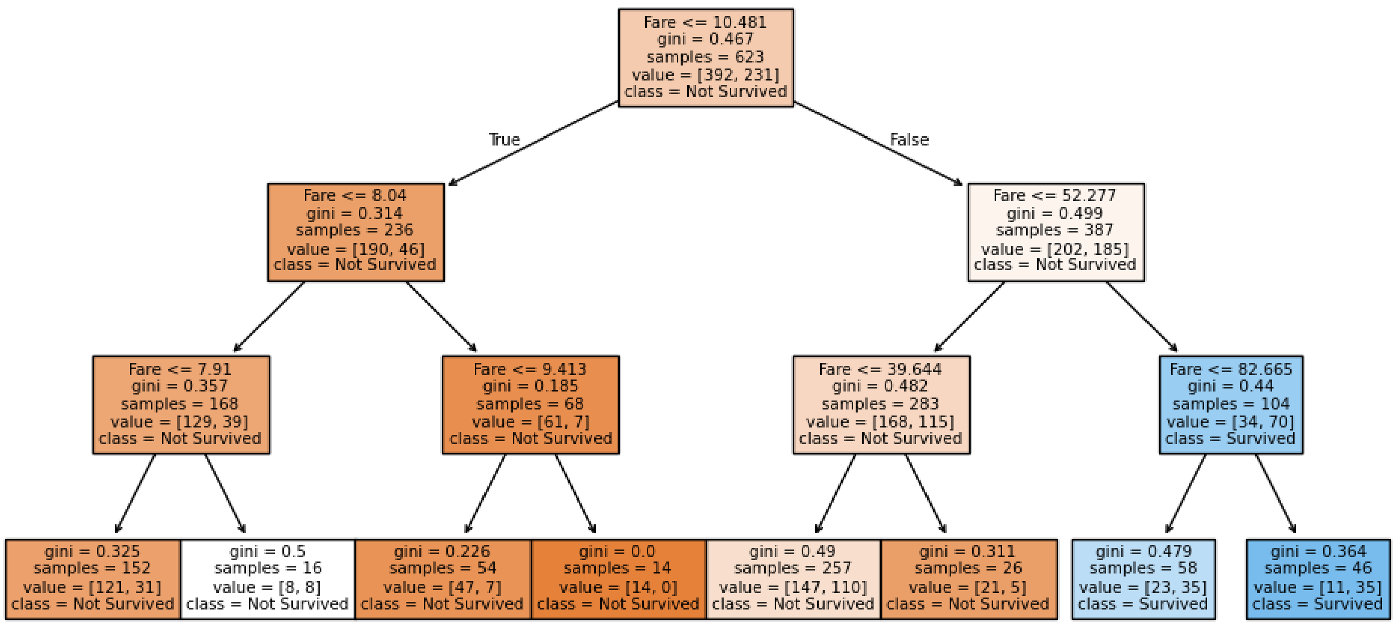
Out[370]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded

0	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [371]:

```
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier, plot_tree
import matplotlib.pyplot as plt


X = df[['Fare']]
y = df['Survived']


X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42
)


model = DecisionTreeClassifier(max_depth=3, random_state=42)
model.fit(X_train, y_train)


plt.figure(figsize=(12,6))
plot_tree(model, feature_names=['Fare'], class_names=['Not Survived','Survived'], filled
=True)
plt.show()


print("Accuracy:", model.score(X_test, y_test))
```




```
Accuracy: 0.6716417910447762
```

CONCLUSION OF THIS POINT: Passengers who paid higher prices (i.e. more then 83 pounds) had a much greater chance of survival.)

In [ ]:

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

In [372]:

```
df.head(5)
```

Out[372]:

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

In [373]:

```
df_copy.head(5)
```

Out[373]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [ ]:

```

```

KNN QUESTION] Using the Titanic dataset, build a K-Nearest Neighbors (KNN) model to predict whether a passenger (male / female) survived or not based on their Age , Gender and Fare. After training, predict the survival status of a female passenger aged 30 years who paid a fare of $100. Finally, find out how well your model performs using the accuracy score.

In [374]:

```
df.head()
```

Out[374]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	S

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	S

In [375]:

```
df_copy.head()
```

Out[375]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [376]:

```
df.isnull().sum()
```

Out[376]:

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

In [377]:

```
df_copy.isnull().sum()
```

Out[377]:

```
Survived                      0
Pclass                        0
Sex                           0
Age                           0
SibSp                         0
Parch                         0
Fare                          0
Embarked                      0
Number of Family Members      0
Embarkation Point Encoded     0
dtype: int64
```

In [378]:

```
df_copy.head()
```

Out[378]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [379]:

```
inputs = df_copy.drop(["Survived","Pclass","SibSp","Parch","Embarked","Number of Family
Members","Embarkation Point Encoded"],axis="columns")
```

In [380]:

```
outputs = df_copy.drop(["Age","Fare","Pclass","Sex","SibSp","Parch","Embarked","Number o
f Family Members","Embarkation Point Encoded"],axis="columns")
```

In [381]:

```
inputs
```

Out[381]:

	Sex	Age	Fare
0	0	22	7
1	1	38	71
2	1	26	7
3	1	35	53
4	0	35	8
...	...	...	...
886	0	27	13
887	1	19	30
888	1	28	23
889	0	26	30
890	0	32	7

891 rows × 3 columns

In [382]:

```
outputs
```

Out[382]:

	Survived
0	0
1	1
2	1
3	1
4	0
...	...
886	0
887	1
888	0
889	1
890	0

891 rows × 1 columns

In [383]:

In [383]:

```
from sklearn.model_selection import train_test_split
X = inputs
y = outputs
```

In [384]:

```
X
```

Out[384]:

	Sex	Age	Fare
0	0	22	7
1	1	38	71
2	1	26	7
3	1	35	53
4	0	35	8
...	...	...	...
886	0	27	13
887	1	19	30
888	1	28	23
889	0	26	30
890	0	32	7

891 rows × 3 columns

In [385]:

```
y
```

Out[385]:

	Survived
0	0
1	1
2	1
3	1
4	0
...	...
886	0
887	1
888	0
889	1
890	0

891 rows × 1 columns

In [386]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=1)
```

In [387]:

```
len(X_train)
```

Out[387]:

```
712
```

In [388]:

```
len(X_test)
```

Out[388]:

```
179
```

Create KNN (K Neighrest Neighbour Classifier)

In [389]:

```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors=5)
```

In [390]:

```
knn.fit(X_train, y_train)
```

Out[390]:

```
▼
KNeighborsClassifier
                    i ?
▶ Parameters
```

In [391]:

```
knn.score(X_test,y_test)
```

Out[391]:

```
0.7318435754189944
```

In [392]:

```
knn.predict([[1,38,71]])
```

Out[392]:

```
array([1])
```

In [393]:

```
df.head()
```

Out[393]:

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

In [394]:

```
df_copy.head()
```

Out[394]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

CONCLUSION OF THIS KNN MODEL: A Female Person of 38 years of age and with an income of 71 pounds (British pounds) is likely to survive

Plot Confusion Matrix

In [395]:

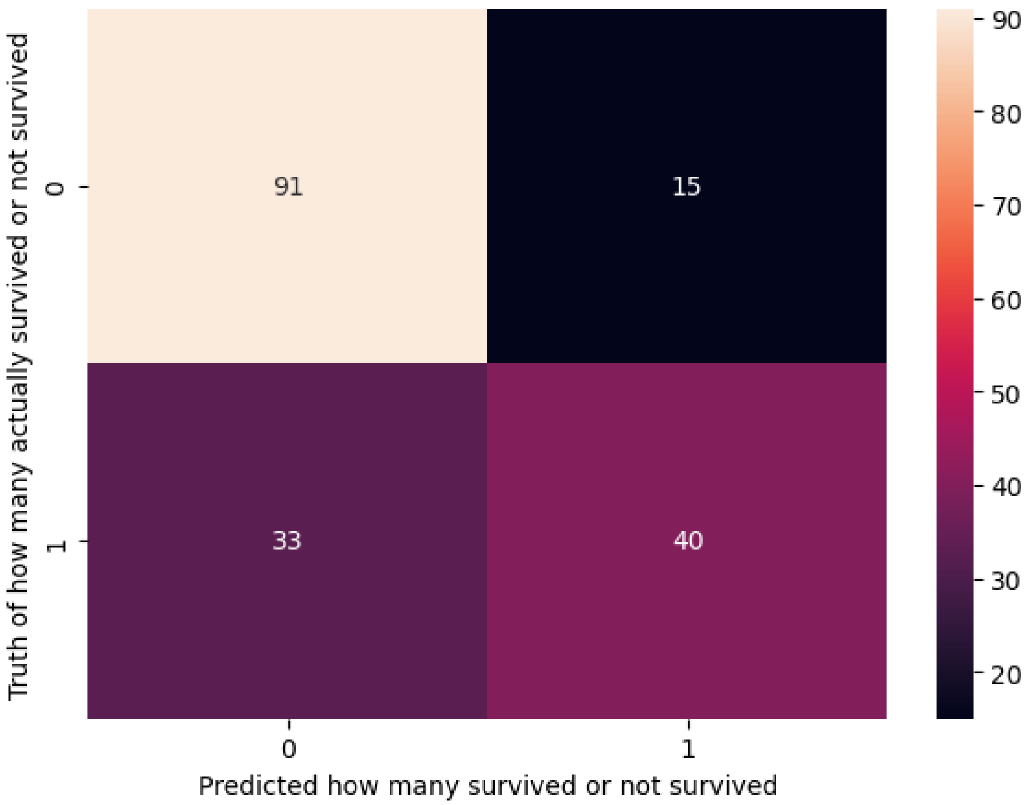
```
from sklearn.metrics import confusion_matrix
y_pred = knn.predict(X_test)
cm = confusion_matrix(y_test, y_pred)
cm
```

Out[395]:

```
array([[91, 15],
       [33, 40]])
```

In [396]:

```
import matplotlib.pyplot as plt
import seaborn as sn
plt.figure(figsize=(7,5))
sn.heatmap(cm, annot=True)
plt.xlabel('Predicted how many survived or not survived')
plt.ylabel('Truth of how many actually survived or not survived')
plt.show()
```



Prepare a classification report:

In [397]:

```
from sklearn.metrics import classification_report
```

```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.73      0.86      0.79       106
           1       0.73      0.55      0.62        73

    accuracy                           0.73       179
   macro avg       0.73      0.70      0.71       179
weighted avg       0.73      0.73      0.72       179
```

Meaning of the heatmap created : 0s and 1s on the heatmap means :

- ***0 means passenger did not survived***
- ***1 means passenger survived***

CONCLUSIONS DRAWN FROM THE ABOVE HEATMAP CREATED :

```
- We accurately predicted that 91 passengers didnt survive and 40 passengers surviv
ed
- 33 passengers actually survived but we falsely predicted that they didnt survive
- We falsely predicted that 15 passengers survived but actually they didnt.
```

In [ ]:

In [ ]:

RANDOM FOREST QUESTION] Using a Random Forest Classifier, find out which features — Sex, Age, or Fare — are most important for predicting survival.

In [398]:

```
df.head()
```

Out[398]:

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

In [399]:

```
df_copy.head()
```

Out[399]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
3	1	1	1	35	1	0	53	S	2	3
4	0	3	0	35	0	0	8	S	1	2

In [400]:

```
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
import numpy as np

X = df_copy[["Sex","Age","Fare"]]
y = df_copy["Survived"]

X_train, X_test, y_train, y_test = train_test_split( X, y, test_size = 0.25, random_stat
e=42) # Split dataset into 75% train and 25% test

randomForest_Model = RandomForestClassifier(n_estimators=100, random_state=42)
randomForest_Model.fit(X_train, y_train)

#Check model score:
randomForest_Model.score(X_test,y_test)
```

Out[400]:

```
0.7668161434977578
```

In [401]:

```
#Make Predictions:
y_predicted = randomForest_Model.predict(X_test)
```

In [402]:

```
y_predicted
```

Out[402]:

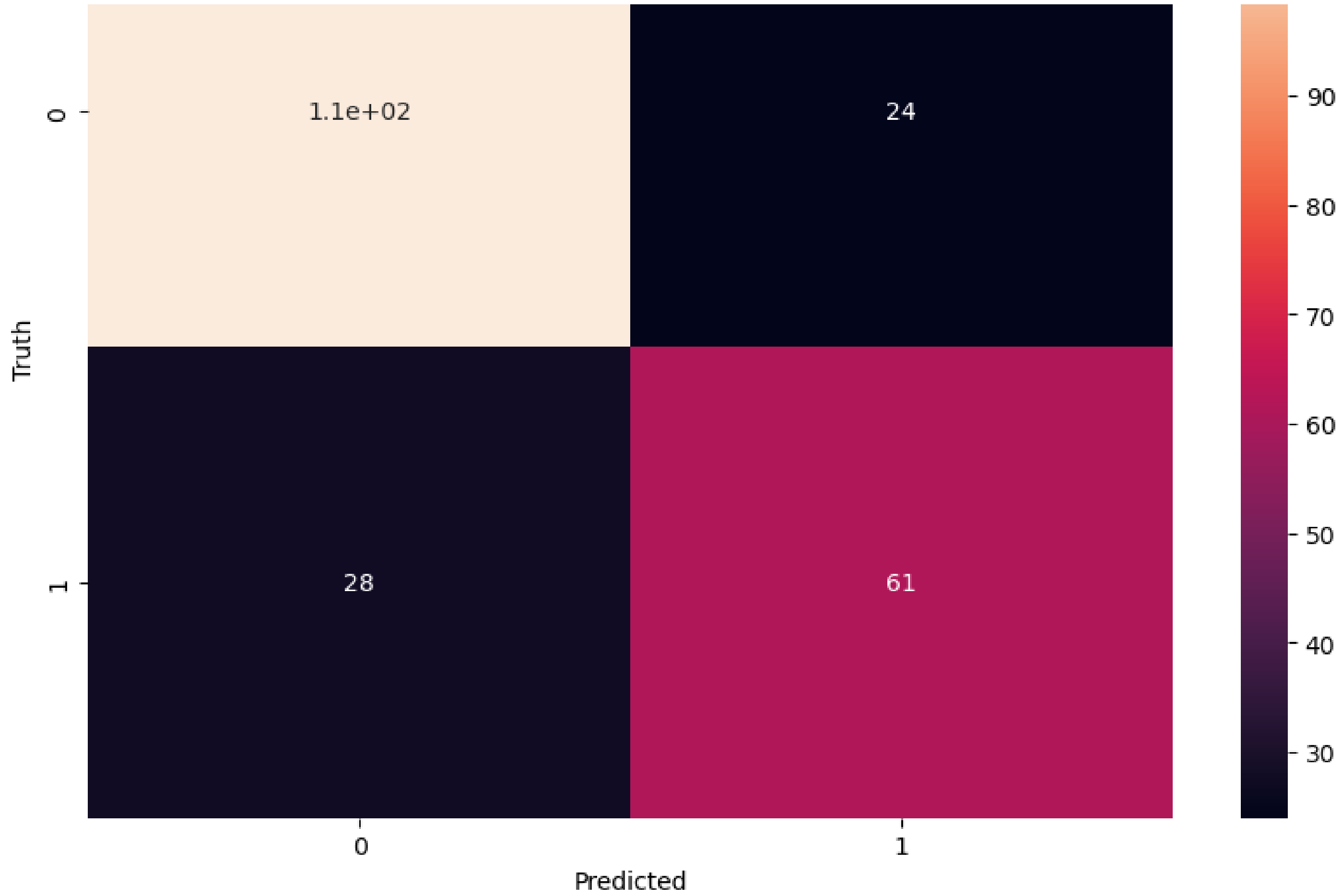
```
array([0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0,
       1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1,
       0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0,
       0, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1,
       0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0,
       1, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0,
       0, 1, 0])
```

In [403]:

```
# Confusion Matrix:
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_predicted)


import matplotlib.pyplot as plt
import seaborn as sn
plt.figure(figsize=(10,7))
sn.heatmap(cm, annot=True)
plt.xlabel('Predicted')
plt.ylabel('Truth')
```

Out[403]:

```
Text(95.72222222222221, 0.5, 'Truth')
```



CONCLUSION FROM THE ABOVE HEATMAP]

- **The model correctly predicted that :**
  - **110 passengers did not survived**
  - **61 passengers survived**
- **The model incorrectly predicted that :**
  - **28 passengers didnt survive ; but actually they did survive**
  - **24 passengers survived ; but actually they didnt**

In [ ]:

```

```

In [ ]:

```

```

In [ ]:

```

```

NAIVE BAYES QUESTION] Predict a passenger's survival chances based on his'/her's passenger-class and family-size ; using naive bayes

In [404]:

```
df_copy.head(5)
```

Out[404]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
0	0	3	0	22	1	0	7	S	2	2
1	1	1	1	38	1	0	71	C	2	0
2	1	3	1	26	0	0	7	S	1	2

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Number of Family Members	Embarkation Point Encoded
3	1	1	1	35	1	0	53	S	2	2
4	0	3	0	35	0	0	8	S	1	2

In [405]:

```
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import accuracy_score

X = df_copy[["Pclass","Number of Family Members"]]
y = df_copy["Survived"]

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42
)

naive_bayes_model = MultinomialNB()
naive_bayes_model.fit(X_train, y_train)

# Make predictions for the testing-data:
y_pred = naive_bayes_model.predict(X_test)

# Check the accuracy of the model:
print("Predicted:", y_pred)
print("Accuracy:", accuracy_score(y_test, y_pred))
```

```
Predicted: [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0]
Accuracy: 0.5783582089552238
```

In [406]:

```
new_passengers = pd.DataFrame([
    [1, 3],    # Example 1: 1st class, 3 family members
    [3, 1],    # Example 2: 3rd class, 1 family member
    [2, 0],    # Example 3: 2nd class, traveling alone
    [3, 5],    # Example 4: 3rd class, 5 family members
    [2,10],    # Example 5: 2nd class, 10 family members
    [1,4],     # Example 6: 1st class, 4 family members
    [3,30]     # Example 7: 3rd class, 30 family members
], columns=["Pclass", "Number of Family Members"])

predictions = naive_bayes_model.predict(new_passengers)

# Show results
result_df = new_passengers.copy()
result_df["Predicted Survival (1=Survived, 0=Not Survived)"] = predictions
result_df
```

Out[406]:

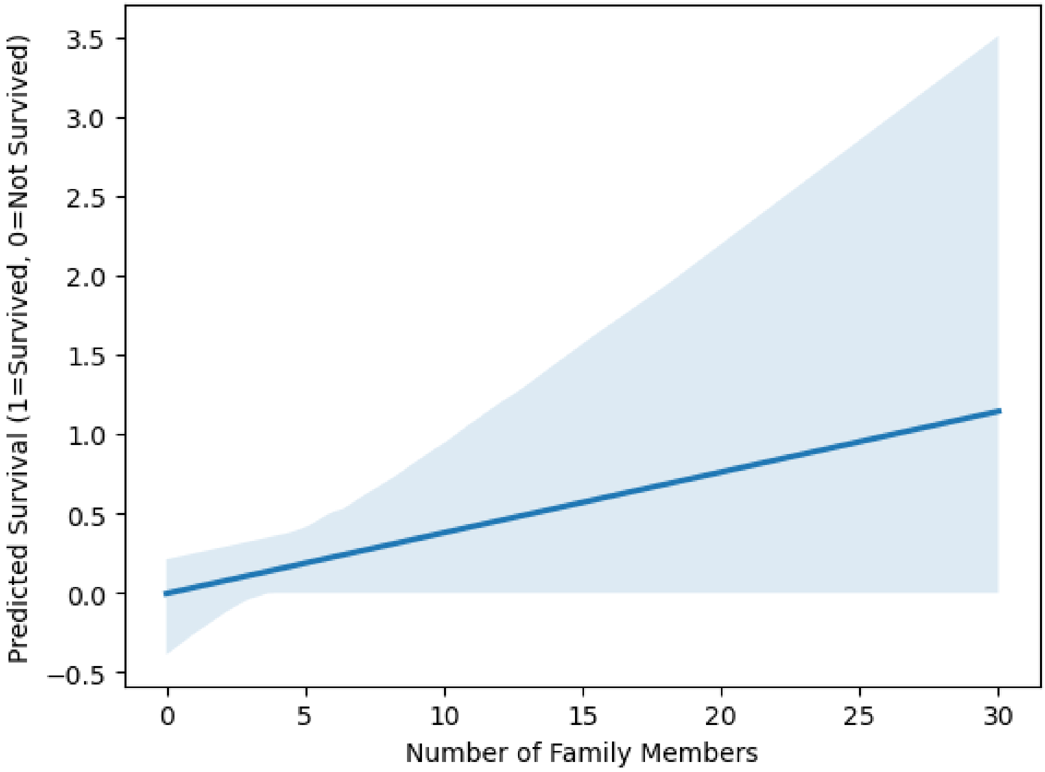
	Pclass	Number of Family Members	Predicted Survival (1=Survived, 0=Not Survived)
0	1	3	0
1	3	1	0
2	2	0	0
3	3	5	0
4	2	10	1
5	1	4	0
6	3	30	1

In [407]:

```
import seaborn as sns
sns.regplot(scatter=False,data=result_df,x="Number of Family Members",y="Predicted Survi
val (1=Survived, 0=Not Survived)")
```

Out[407]:

```
<Axes: xlabel='Number of Family Members', ylabel='Predicted Survival (1=Survived, 0=Not S
urvived)'>
```



CONCLUSION OF THE ABOVE VISUALIZATION: Larger families had the highest chance of survival.

In [ ]:

In [ ]:

In [ ]:

In [408]:

```
from IPython.display import Image, display

display(Image(filename="ending_image.jpg", width=700,height=300))
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

END OF THE NOTEBOOK

Prepared by:

- **Name: Om Satyawan Pathak**
- **Contact: omsatyawanpathakwebdevelopment@gmail.com (or) omsatyawanpathakgit@gmail.com**

In [ ]: