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Course and Section: CPE019 - CPE32S1
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Code cell #1

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns


#create a pandas dataframe called "training" from the titanic-train.csv file
training = pd.read_csv("titanic_train.csv")
testinng = pd.read_csv("titanic_test.csv")


#Code cell 2
#verify the contents of the training dataframe using the pandas info() method.
#training.?

training
```

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

Next steps: Generate code with training View recommended plots

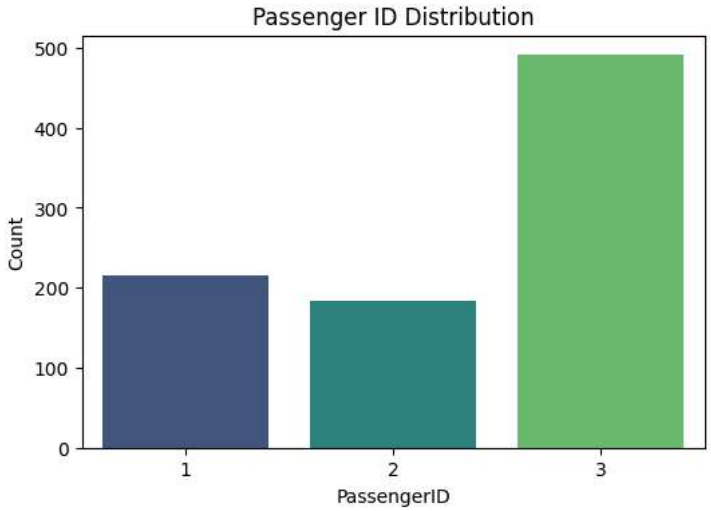
```
#Code cell 3
#view the first few rows of the data

training.head()
```

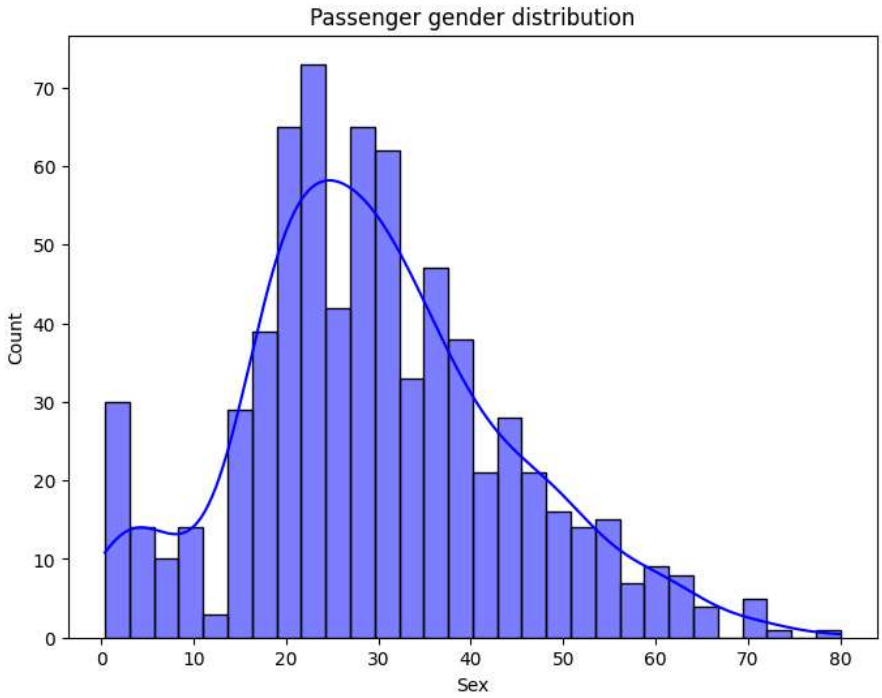
	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.250
1	2	1	1	Cumings, Mrs. John Bradley (Florence	female	38.0	1	0	PC 17599	71.283

Next steps: Generate code with training View recommended plots

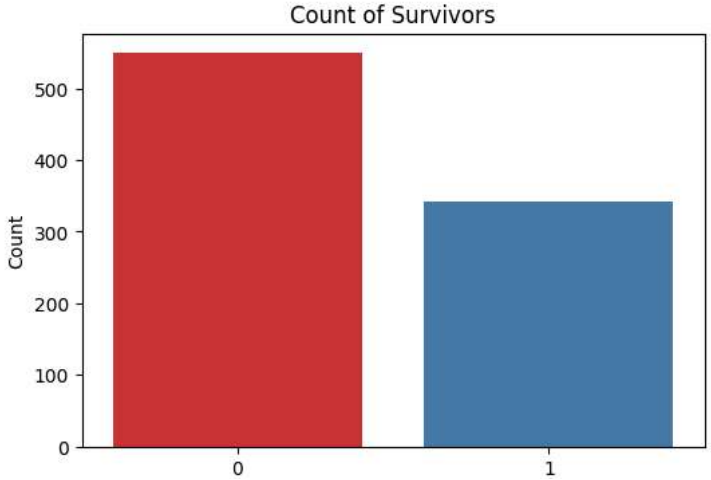
```
plt.figure(figsize=(6, 4))
sns.countplot(data=training, x='Pclass', palette='viridis')
plt.title('Passenger ID Distribution')
plt.xlabel('PassengerID')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(8, 6))
sns.histplot(training['Age'].dropna(), kde=True, bins=30, color='blue')
plt.title('Passenger gender distribution')
plt.xlabel('Sex')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(6, 4))
sns.countplot(data=training, x= 'Survived', palette='Set1')
plt.title('Count of Survivors')
plt.xlabel('Survived')
plt.ylabel('Count')
plt.show()
```

```
<ipython-input-47-c97a4e316eb2>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0.

  sns.countplot(data=training, x='Pclass', palette='viridis')
```






```
<ipython-input-47-c97a4e316eb2>:16: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0.

  sns.countplot(data=training, x= 'Survived', palette='Set1')
```

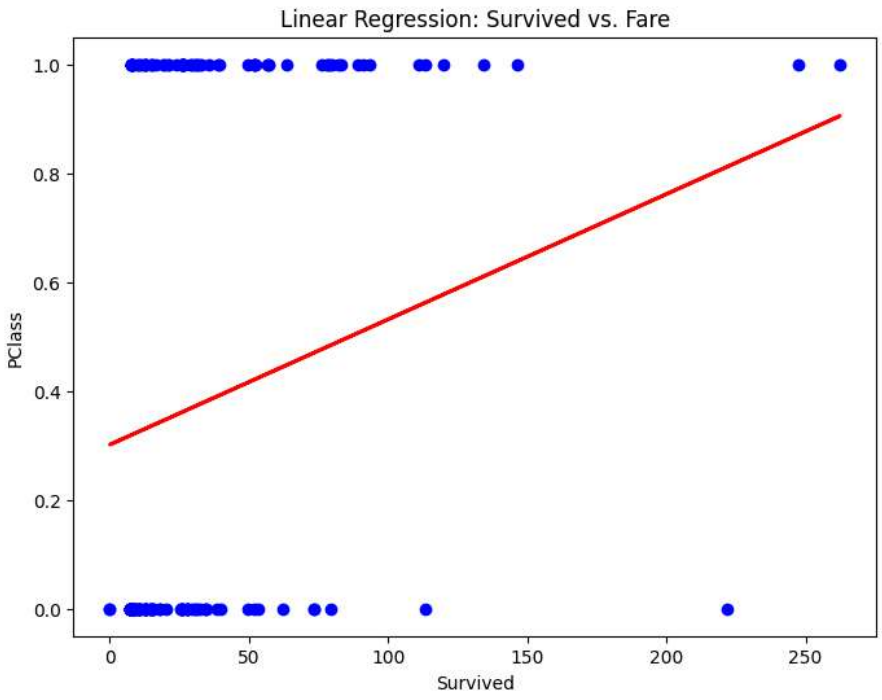


Survived

```
#Perform Simple Linear Regression
data = training [['Fare', 'Survived']].dropna ()

# Split the data into X and y
X = data[['Fare']]
y= data['Survived']

from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize and fit the linear regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Calculate performance metrics
mse = mean_squared_error(y_test, y_pred)

r2 = r2_score (y_test, y_pred)
print (f"Mean Squared Error: {mse:.2f}")
print (f"R-squared: {r2:.2f}")
```

```
Mean Squared Error: 0.22
R-squared: 0.08
```

```
# Visualize the linear regression line
plt.figure(figsize=(8, 6))
plt.scatter (X_test, y_test, color='blue')
plt.plot(X_test, y_pred, color='red', linewidth=2)
plt.title('Linear Regression: Survived vs. Fare')
plt.xlabel('Survived')
plt.ylabel('PClass')
plt.show()
```

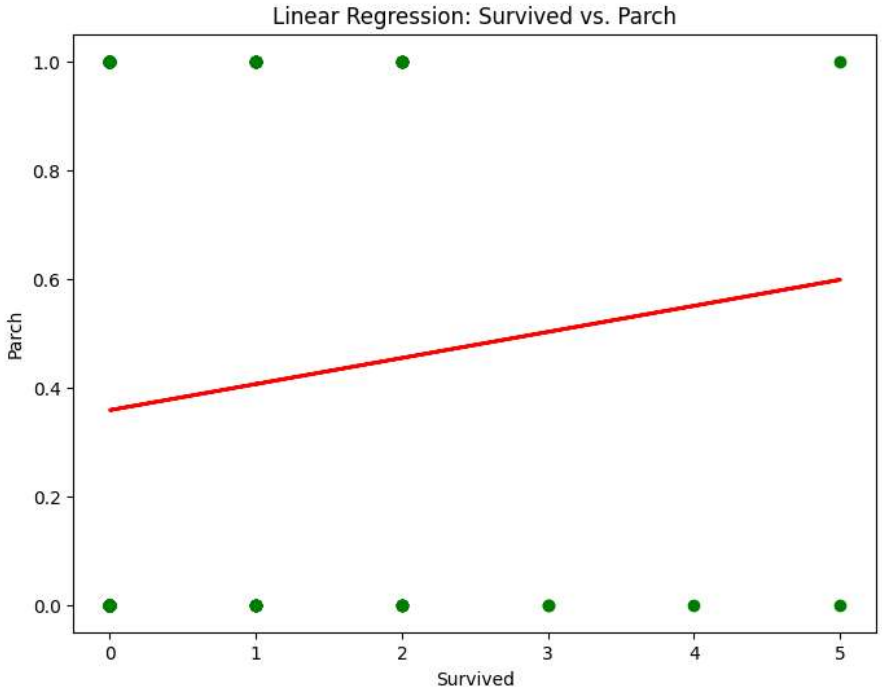


```
data = training [['SibSp', 'Survived']].dropna ()

# Split the data into X and y
X = data[['SibSp']]
y= data['Survived']

from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize and fit the linear regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Calculate performance metrics
mse = mean_squared_error(y_test, y_pred)

r2 = r2_score (y_test, y_pred)
print (f"Mean Squared Error: {mse:.2f}")
print (f"R-squared: {r2:.2f}")

# Visualize the linear regression line
plt.figure(figsize=(8, 6))
plt.scatter (X_test, y_test, color='red')
plt.plot(X_test, y_pred, color='green', linewidth=2)
plt.title('Linear Regression: Survived vs. Siblings or Spouse onboard')
plt.xlabel('Survived')
plt.ylabel('SibSp')
plt.show()
```

```
Mean Squared Error: 0.24
R-squared: -0.01
```

```
data = training [['Parch', 'Survived']].dropna ()

# Split the data into X and y
X = data[['Parch']]
y= data['Survived']

from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize and fit the linear regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Calculate performance metrics
mse = mean_squared_error(y_test, y_pred)

r2 = r2_score (y_test, y_pred)
print (f"Mean Squared Error: {mse:.2f}")
print (f"R-squared: {r2:.2f}")

# Visualize the linear regression line
plt.figure(figsize=(8, 6))
plt.scatter (X_test, y_test, color='green')
plt.plot(X_test, y_pred, color='red', linewidth=2)
plt.title('Linear Regression: Survived vs. Parch')
plt.xlabel('Survived')
plt.ylabel('Parch')
plt.show()
```

```
Mean Squared Error: 0.24
R-squared: 0.00
```



PART 2

Step 1: Create the dataframe

a) Import pandas and the csv file

```
#Code cell 1
import pandas as pd
import numpy as np



#create a pandas dataframe called "training" from the titanic-train.csv file
training = pd.read_csv("titanic_train.csv")


#Code cell 2
#verify the contents of the training dataframe using the pandas info() method.
#training.?

training.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
```

Are there missing values in the data set?

Yes, there is a lot of data in the values of the Titanic Train dataset.

```
#Code cell 3
#view the first few rows of the data

training.head()
```

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

Next steps: Generate code with `training` View recommended plots

```
print(training.columns)
#code cell 4
training["Sex"]= training["Sex"].apply(lambda toLabel: 0 if toLabel == 'male' else 1)
```

```
Index(['PassengerId', 'Survived', 'Pclass', 'Name', 'Sex', 'Age', 'SibSp',
       'Parch', 'Ticket', 'Fare', 'Cabin', 'Embarked'],
      dtype='object')
```

```
#code cell 5
training.head()
```

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

Next steps: Generate code with `training` View recommended plots

```
#code cell 6
training['Age'].fillna(training['Age'].mean(), inplace=True)


#code cell 7
#verify that the missing values for the age variable have been eliminated.

missing_age_count = training['Age'].isna().sum()
print("No. of missing values in 'Age' column: ", missing_age_count)
```

```
No. of missing values in 'Age' column:  0
```

What is the value that was used to replace the missing ages

- Fillna was employed to substitute for the absent ages.

```
#Use code to answer the question above
training.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    int64  
 5   Age          891 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(6), object(4)
memory usage: 83.7+ KB
```

Step 3: Train and Score the Decision Tree Model

```
 #code cell 8
#create the array for the target values
y_target = training["Survived"].values


#code cell 9
columns = ["Fare", "Pclass", "Sex", "Age", "SibSp"]
#create the variable to hold the features that the classifier will use
X_input = training[list(columns)].values
```

```
#code cell 10
#import the tree module from the sklearn library
from sklearn import tree

#create clf_train as a decision tree classifier object
clf_train = tree.DecisionTreeClassifier(criterion="entropy", max_depth=3)

#train the model using the fit() method of the decision tree object.
#Supply the method with the input variable X_input and the target variable y_target
clf_train = clf_train.fit(X_input, y_target)


#code cell 11
clf_train.score(X_input,y_target)
```

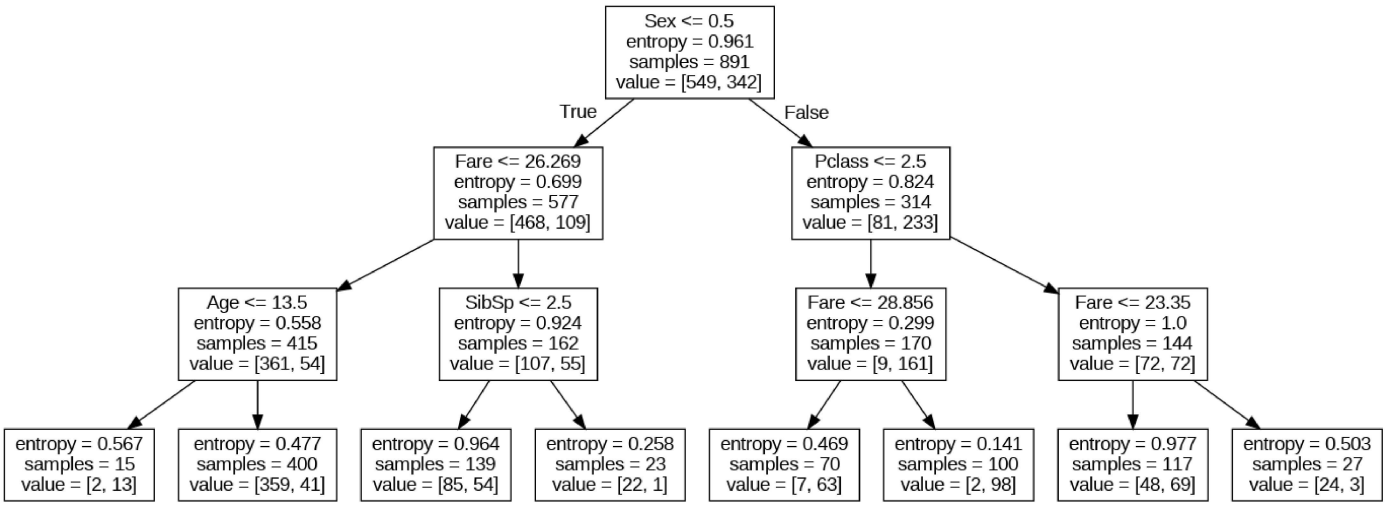
```
0.8226711560044894
```

Step 6: Visualize the Tree

```
#code cell 12
from sklearn.tree import export_graphviz
dot_file_path = "titanic.dot"
with open(dot_file_path, 'w') as f:
  f = export_graphviz(clf_train, out_file=f, feature_names=columns)


!apt-get install graphviz
```

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
graphviz is already the newest version (2.42.2-6).
0 upgraded, 0 newly installed, 0 to remove and 45 not upgraded.
```

```
#code cell 13
#run the Graphviz dot command to convert to convert the .dot file to .png
!dot -Tpng ./titanic.dot -o ./titanic.png


#code cell 14
#import the Image module from the Ipython.display library
from IPython.display import Image

Image(filename = "./titanic.png")
```



What describes the group that had the most deaths by number? Which group had the most survivors?

- In the sex category, males were the group with the highest mortality toll. Conversely, when it comes to survivors' age, the average age of survivors is higher than 13.5.

Part 3

```
#code cell 15
#import the file into the 'testing' dataframe.
path = "titanic_test.csv"
testing = pd.read_csv(path)
testing.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 11 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  418 non-null    int64
 1   Pclass       418 non-null    int64
 2   Name         418 non-null    object
 3   Sex          418 non-null    object
 4   Age          332 non-null    float64
 5   SibSp        418 non-null    int64
 6   Parch        418 non-null    int64
 7   Ticket       418 non-null    object
 8   Fare         417 non-null    float64
 9   Cabin        91 non-null     object
 10  Embarked     418 non-null    object
dtypes: float64(2), int64(4), object(5)
memory usage: 36.0+ KB
```

How many records are in the data set?

- 418

Which important variables(s) are missing values and how many are missing?

- The number 86 is missing from the Age category. Conversely, the Fare category's missing value is 1.

```
#code cell 16
#replace the Gender labels in the testing dataframe
# Hint: look at code cell 4
testing["Sex"] = testing["Sex"].apply(lambda toLabel: 0 if toLabel == 'male' else 1)
training.head()
```

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

Next steps: Generate code with `training` View recommended plots

```
#code cell 17
#Use the fillna method of the testing dataframe column "Age"
#to replace missing values with the mean of the age values.
testing["Age"].fillna(testing["Age"].mean(), inplace=True)
testing["Fare"].fillna(testing["Fare"].mean(), inplace=True)
```

```
#code cell 18
#verify the data preparation steps. Enter and run both the info and head
#methods from here, by entering and running one and then the other.
testing.head(10)
```

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	892	3	Kelly, Mr. James	0	34.5	0	0	330911	7.8292	NaN	Q
1	893	3	Wilkes, Mrs. James (Ellen Needs)	1	47.0	1	0	363272	7.0000	NaN	S
2	894	2	Myles, Mr. Thomas Francis	0	62.0	0	0	240276	9.6875	NaN	Q
3	895	3	Wirz, Mr. Albert	0	27.0	0	0	315154	8.6625	NaN	S
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	1	22.0	1	1	3101298	12.2875	NaN	S
5	897	3	Svensson, Mr. Johan Cervin	0	14.0	0	0	7538	9.2250	NaN	S
6	898	3	Connolly, Miss. Kate	1	30.0	0	0	330972	7.6292	NaN	Q
7	899	2	Caldwell, Mr. Albert Francis	0	26.0	1	1	248738	29.0000	NaN	S
8	900	3	Abrahim, Mrs. Joseph (Sophie Halaut Easu)	1	18.0	0	0	2657	7.2292	NaN	C
9	901	3	Davies, Mr. John Samuel	0	21.0	2	0	A/4 48871	24.1500	NaN	S

Next steps: Generate code with testing View recommended plots

```
#code cell 19
#create the variable X_input to hold the features that the classifier will use
X_input = testing[list(columns)].values


#Code cell 20
#apply the model to the testing data and store the result in a pandas dataframe.
#Use X_input as the argurment for the predict() method of the clf_train classifier object
target_labels = clf_train.predict(X_input)
#convert the target array into a pandas dataframe using the pd.DataFrame() method and target as argument
target_labels = pd.DataFrame({'Est_Survival':target_labels, 'Name':testing['Name']})
testing.head(20)
```

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	892	3	Kelly, Mr. James	0	34.50000	0	0	330911	7.8292	NaN	Q
1	893	3	Wilkes, Mrs. James (Ellen Needs)	1	47.00000	1	0	363272	7.0000	NaN	S
2	894	2	Myles, Mr. Thomas Francis	0	62.00000	0	0	240276	9.6875	NaN	Q
3	895	3	Wirz, Mr. Albert	0	27.00000	0	0	315154	8.6625	NaN	S
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	1	22.00000	1	1	3101298	12.2875	NaN	S
5	897	3	Svensson, Mr. Johan Cervin	0	14.00000	0	0	7538	9.2250	NaN	S
6	898	3	Connolly, Miss. Kate	1	30.00000	0	0	330972	7.6292	NaN	Q
7	899	2	Caldwell, Mr. Albert Francis	0	26.00000	1	1	248738	29.0000	NaN	S
8	900	3	Abrahim, Mrs. Joseph (Sophie Halaut Easu)	1	18.00000	0	0	2657	7.2292	NaN	C
9	901	3	Davies, Mr. John Samuel	0	21.00000	2	0	A/4 48871	24.1500	NaN	S
10	902	3	Ilieff, Mr. Ylio	0	30.27259	0	0	349220	7.8958	NaN	S
11	903	1	Jones, Mr. Charles Cresson	0	46.00000	0	0	694	26.0000	NaN	S
12	904	1	Snyder, Mrs. John Pillsbury (Nelle Stevenson)	1	23.00000	1	0	21228	82.2667	B45	S
13	905	2	Howard, Mr. Benjamin	0	63.00000	1	0	24065	26.0000	NaN	S
14	906	1	Chaffee, Mrs. Herbert Fuller (Carrie Constance...	1	47.00000	1	0	W.E.P. 5734	61.1750	E31	S
15	907	2	del Carlo, Mrs. Sebastiano (Argenia Genovesi)	1	24.00000	1	0	SC/PARIS 2167	27.7208	NaN	C
16	908	2	Keane, Mr. Daniel	0	35.00000	0	0	233734	12.3500	NaN	Q
17	909	3	Assaf, Mr. Gerios	0	21.00000	0	0	2692	7.2250	NaN	C

Next steps: Generate code with testing View recommended plots

```
#code cell 21
#import the numpy library as np
```

```
import numpy as np
# Load data for all passengers in the variable all_data
path = "titanic_train.csv"
all_data = pd.read_csv(path)
# Merging using the field Name as key, selects only the rows of the two datasets that refer to the same passenger
testing_results = pd.merge(target_labels, all_data[['Name','Survived']], on=['Name'])
# Compute the accuracy as a ratio of matching observations to total osbervations. Store this in in the variable acc.
acc = np.sum(testing_results['Est_Survival'] == testing_results['Survived']) /float(len(testing_results))
# Print the result
print(acc)
```

```
1.0
```

```
#code cell 22
#import the titanic_all.csv file into a dataframe called all_data. Specify the list of columns to import.
path = "titanic_train.csv"
all_data = pd.read_csv(path, usecols=['Survived','Pclass','Sex','Age','SibSp','Fare'])
```