Exploratory Data Analysis Using Python - Lab Manual

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List of Programs

0 - Get the Largest Number from a List

Write a python program to get the largest number from a list.

```
Program - Version 1
-------------------
list=[10,20,30]
print("List:", list)
print("The largest element is:", max(list))

Program - Version 2
-------------------
list1=[]
while True :
  print("Enter an integer to the list:")
  element = int(input())
  list1.append(element)
  print("Is it end of list?(y/n)")
  flag = input()
  if flag == "y" :
    break
print("The List =", list1)
print("Maximum Value in this list:", max(list1))
```

0 - Remove Duplicates from a List

Write a python program to remove duplicates from a list.

```
Program - Version 1
-------------------
list1=[20,20,10,30,30]
print("Duplicated List:", list1)
list2=[]
for i in list1:
    if i not in list2:
        list2.append(i)
print("Deduplicated List:", list2)

Program - Version 2
-------------------
list1 = [9,9,5,6,3,4,1,9,2,4,2]
```

```
print("Original List:", list1)
list2 = list(set(list1))
print("Duplicates Removed List : ", list2)
```

0 - Conversion of Tuple to Dictionary

Write a python program to convert a tuple to a dictionary.

```
Program
-------
tuple = (('Rajesh', 75),('Vasudevan', 80), ('Thomas', 85))
print("Tuple=",tuple)
dictionary = dict(tuple)
print("Dictionary=",dictionary)
```

0 - Merging Dictionaries

Write a python program to merge two python dictionaries.
Hint - Use update() method or ** operator or | operator

```
Program - Version 1
-------------------
dict1 = {'a': 1, 'b': 2}
print("Dictionary 1=",dict1)
dict2 = {'c': 3, 'd': 4}
print("Dictionary 2=",dict2)

# Merging dict2 into dict1
dict1.update(dict2)

print(dict1)
```

```
Program - Version 2
-------------------
dict1 = {'a': 1, 'b': 2}
print("Dictionary 1=",dict1)
dict2 = {'c': 3, 'd': 4}
print("Dictionary 2=",dict2)
```

```
# Merging dictionaries
merged_dictionary = {**dict1, **dict2}

print("Merged Dictionary=", merged_dictionary)

Program - Version 3
-------------------
dict1 = {'a': 1, 'b': 2}
print("Dictionary 1=",dict1)
dict2 = {'c': 3, 'd': 4}
print("Dictionary 2=",dict2)

# Merging dictionaries
merged_dictionary = dict1|dict2

print("Merged Dictionary=", merged_dictionary)
```

0 - Checking Common Member in Lists

Write a python program that takes two lists and returns true if they have at least one common member.

```
Program
-------
list1=[10,20,30]
# list is converted to set to make the elements unique
# and to perform set operations
set1=set(list1)
list2=[40,50,60]
set2=set(list2)
result=set1 & set2
# If there is no common element, then result = set()
if (result== set()):
    print("False")
else :
    print("True")
```

0 - Find Earlier Date

Write a python program to determine which one is the earlier date from the two given dates.

```
Program
-------
date1="2025-01-26"
date2="2025-08-15"
if date1<date2 :
    print("Earlier date is", date1)
elif date1>date2 :
    print("Earlier date is", date2)
else:
    print("Two dates are equal")
```

0 - Subtract 5 Days from Current Date

Write a python program to subtract 5 days from current date.

```
Program
-------
import datetime
today=datetime.date.today()
no_of_days=datetime.timedelta(days=5)
print(today-no_of_days)
```

0 - File Copy Operation

Write a Python program to open a file and copy the contents to another file.

```
Program
-------
source_file=open("file1.txt","r")
contents=source_file.read()
source_file.close()
destination_file=open("file2.txt","w")
destination_file.write(contents)
destination_file.close()
```

0 - Capitalise Each Word in a File

Write a python program to capitalise each word in a file.
Hint - Use str.upper() method

```
Program
-------
file=open("file1.txt","r")
contents=file.read()
new_contents=contents.upper()
file.close()
file=open("file1.txt","w")
file.write(new_contents)
file.close()
```

0 - Search and Replace in a File

Write a Python program to search for a word in a file and replace it with another word.
Hint - Use str.replace("old text","new text") method

```
Program
-------
file=open("file1.txt","r")
contents=file.read()
new_contents=contents.replace("Python","C")
file.close()
file=open("file1.txt","w")
file.write(new_contents)
file.close()
```

0 - Count Number of Lines in a File

Write a python program to count number of lines in a file.

```
Program
-------
count = 0
file = open("file1.txt", "r")
for line in file:
 count = count + 1
print("Number of Lines:", count)
```

0 - Retrieve Lines Having Two Consecutive 1's

Write a python program to retrieve lines having two consecutive 1's.

```
Program
-------
lines_with_consecutive_ones = []
file = open("file1.txt", "r")
for line in file:
    if '11' in line:  # Check for two consecutive '1's
        lines_with_consecutive_ones.append(line.strip()) # remove leading
                                                         # and trailing
                                                         # white space
print(lines_with_consecutive_ones)
print("Lines containing two consecutive '1's:")
for line in lines_with_consecutive_ones:
    print(line)
```

0 - Matrix Operations Using Vectorisation

Write python programs to perform the following matrix operations using vectorisation. (Use matrices of order 3 X 3)

1. addition
2. subtraction
3. multiplication
4. scalar multiplication
5. transpose

```
Program
-------
import numpy
matrix1=numpy.matrix([[1,2,3],[1,1,1],[1,1,1]])
matrix2=numpy.matrix([[1,0,0],[0,1,0],[0,0,1]])
print("Matrix 1=\n",matrix1)
print("Matrix 2=\n",matrix2)
```

```
matrix3 = numpy.add(matrix1,matrix2)
matrix4 = numpy.subtract(matrix1,matrix2)
matrix5 = numpy.matmul(matrix1,matrix2)
matrix6 = numpy.transpose(matrix1)
print("Matrix 1 + Matrix 2=\n", matrix3)
print("Matrix 1 - Matrix 2=\n", matrix4)
print("Matrix 1 * Matrix 2=\n", matrix5)
print("2 * Matrix 1=\n", 2*matrix1)
print("Transpose of Matrix 1=\n", matrix6)
```

1 - Introduction to Python Libraries for Data Analysis(Pandas,NumPy,Matplotlib)

You can use the Titanic dataset for practice:

https://raw.githubusercontent.com/datasciencedojo/datasets /master/titanic.csv

This contains details of passengers on the British ship Titanic that sank on 15 April,1912.

PassengerID: A unique identifier for each passenger.
Survived: Survival Status (1 = Survived, 0 = Not Survived)
Pclass: Ticket class (1 = Upper, 2 = Middle, 3 = Lower).
Name: Name of the passenger.
Sex: Gender of the passenger.
Age: Age of the passenger.
SibSp: Number of siblings or spouses aboard.
Parch: Number of parents or children aboard.
Ticket: Ticket number.
Fare: Passenger fare.
Cabin: Cabin number (if available).
Embarked: Port of embarkation (C = Cherbourg, Q = Queenstown, S = Southampton).

1. Create a NumPy array with values from 1 to 50.

   Find its: Mean, Maximum, Minimum, Standard deviation

2. Load the Titanic dataset using NumPy Find: Number of passengers, Number of survivors, Average age of passengers

3. Using Matplotlib:

   (i) Plot a histogram of the Fare column in Titanic dataset.

(ii) Plot a bar chart showing the number of passengers by Pclass.

(iii) Plot a line chart showing numbers from 1 to 10 and their squares.

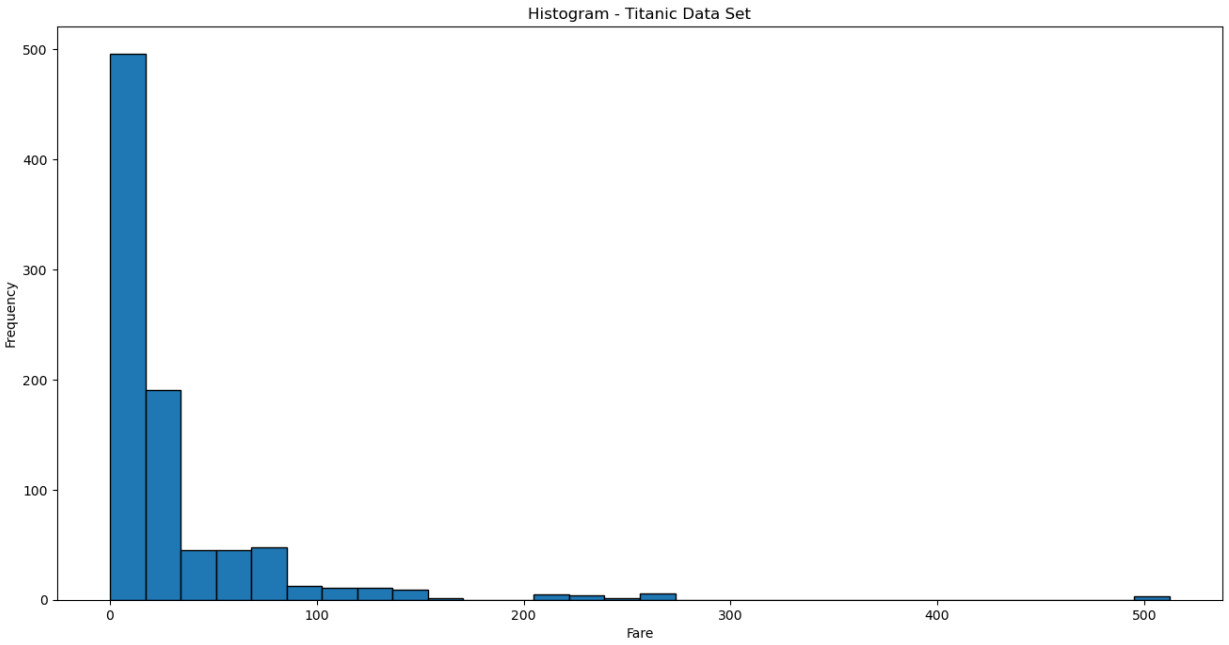
```
Program 1
---------
# Imports the numpy module, used for numeric computing
import numpy

# Create a NumPy array with values from 1 to 50
# Generates an array with values starting from 1 up to,but not including,51
array = numpy.arange(1, 51)

# Calculate the mean
mean_value = numpy.mean(array)

# Calculate the maximum
max_value = numpy.max(array)

# Calculate the minimum
min_value = numpy.min(array)

# Calculate the standard deviation
std_deviation = numpy.std(array)

# Output the results
print("Array:", array)
print("Mean:", mean_value)
print("Maximum:",max_value)
print("Minimum:",min_value)
print("Standard Deviation:","%.2f" % std_deviation)

Output
------
Mean: 25.5
Maximum: 50
Minimum: 1
Standard Deviation: 14.43

Program 2
---------
# Imports the numpy module, used for numeric computing
import numpy
```

```
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Load Titanic dataset
titanic_data = pandas.read_csv('titanic.csv')

# Converting DataFrame to NumPy array for analysis
data_array = titanic_data.to_numpy()

# data_array.shape[0] returns the number of rows in a numpy array
# data_array.shape[1] returns the number of columns in a numpy array
# data_array.shape returns the number of rows and columns in a numpy array
# Number of passengers
number_of_passengers = data_array.shape[0]

# Number of survivors (assuming 'Survived' column indicates 0 for No
# and 1 for Yes)
# Assuming 'Survived' is in the second column
number_of_survivors = numpy.sum(data_array[:, 1])

# Retrieve the passenger ages from sixth column of the numpy array
ages = data_array[:, 5]

# Convert ages to float
ages = ages.astype(float)

# Calculate the average age while ignoring NaN values
average_age = numpy.nanmean(ages)

# Output results
print("Number of passengers:",number_of_passengers)
print("Number of survivors:", number_of_survivors)
# Prints with precision 2 after decimal point
print("Average age of passengers:","%.2f" % average_age)

Output
------
Number of passengers: 891
Number of survivors: 342
Average age of passengers: 29.70
```

Program 3(i)

```
# import pandas module used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# load the Titanic dataset
titanic_data = pandas.read_csv('titanic.csv')
# plots the histogram of fare attribute
# edge colour is set as black
# number of bins is set as 30 ( By default bins = 10 )
titanic_data['Fare'].plot(kind='hist', edgecolor="black", bins=30)
# sets the title
pyplot.title("Histogram - Titanic Data Set")
# sets the x-axis label
pyplot.xlabel('Fare')
# shows the histogram
pyplot.show()
```

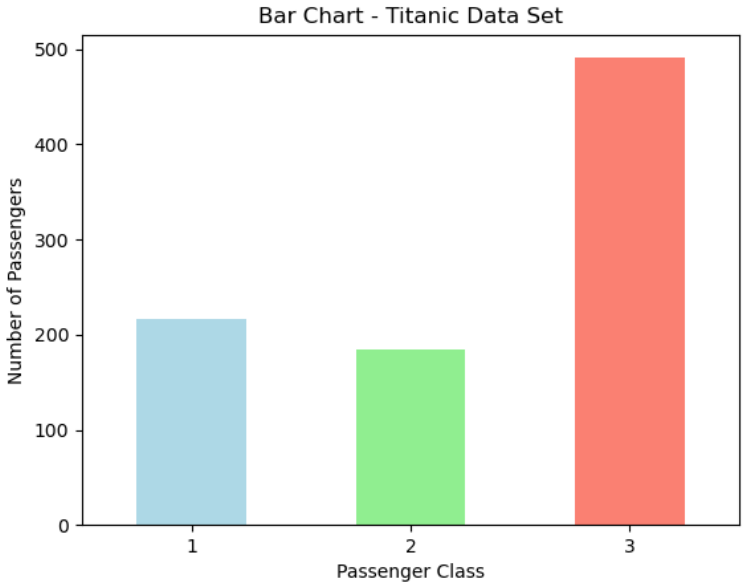
Output



Program 3(ii)

```
# import pandas module used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Load the Titanic dataset
titanic_data = pandas.read_csv('titanic.csv')
# Count the number of passengers by Pclass sorted by Pclass order
pclass_counts = titanic_data['Pclass'].value_counts().reindex([1,2,3])
# plots the bar chart with different colours for each Pclass
pclass_counts.plot(kind='bar', color=['lightblue', 'lightgreen', 'salmon'])
# sets the title
pyplot.title('Bar Chart - Titanic Data Set')
# sets the x-axis label
pyplot.xlabel('Passenger Class')
# sets the y-axis label
pyplot.ylabel('Number of Passengers')
# displays x-axis tick labels horizontally( default behaviour is vertical )
pyplot.xticks(rotation='horizontal')
# shows the bar chart
pyplot.show()
```

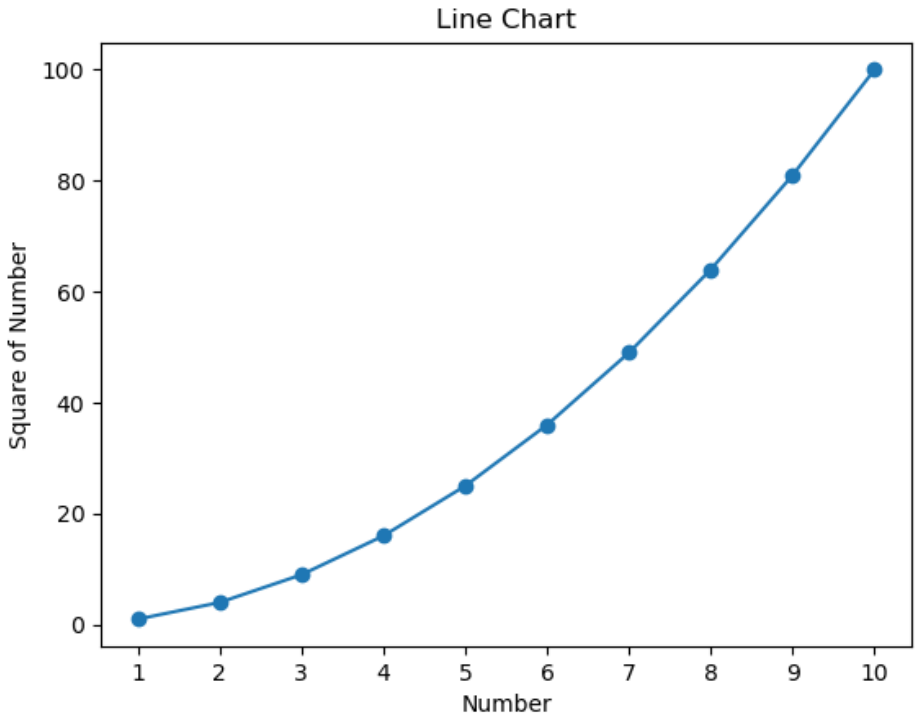
Output



Program 3(iii)

```
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Data: numbers from 1 to 10 stored in a list x
x = list(range(1, 11))
# Calculate their squares stored in a list y
y = [i ** 2 for i in x]
# plots the line chart, adding circular markers at each data point
pyplot.plot(x, y,marker='o')
# Adding title and labels
pyplot.title('Line Chart')
pyplot.xlabel('Number')
pyplot.ylabel('Square of Number')
# Set x-ticks to the numbers
pyplot.xticks(x)
# Show the plot
pyplot.show()
```

Output



2 - Data Importing and Basic Exploration Using Pandas

Load the Titanic dataset.

1. Print (i) Number of rows and columns (ii) Column data types (iii) Number of missing values in each column (iv) Basic descriptive statistics
2. Find (i) The number of passengers in each class (ii) The average age of passengers (iii) The number of survivors

```
Program 1
---------
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')

# titanic_data.shape returns the number of rows and columns in the data
# frame
number_of_rows, number_of_columns = titanic_data.shape

# Print number of rows and columns
print("Titanic data set")
print("----------------")
print("Number of rows:",number_of_rows)
print("Number of columns:", number_of_columns)

# Print column data types
print("Column data types")
print("-----------------")
print(titanic_data.dtypes)

# Calculate and print the number of missing values in each column
# titanic_data.isnull()creates a DataFrame of the same shape as
# titanic_data, but with True for missing values and False for non-missing
# values
# .sum() counts the number of True values (i.e., missing values) for each
# column
missing_values = titanic_data.isnull().sum()
print("Number of missing values")
print("------------------------")
```

```
print(missing_values)

# Print basic descriptive statistics
print("Basic Descriptive Statistics")
print("----------------------------")
descriptive_stats = titanic_data.describe()
print(descriptive_stats)
```

Output

```
Titanic data set
----------------
Number of rows: 891
Number of columns: 12
Column data types
-----------------
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
Number of missing values
------------------------
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
```

```
Basic Descriptive Statistics
----------------------
       PassengerId    Survived      Pclass  ...       SibSp       Parch        Fare
count   891.000000  891.000000  891.000000  ...  891.000000  891.000000  891.000000
mean    446.000000    0.383838    2.308642  ...    0.523008    0.381594   32.204208
std     257.353842    0.486592    0.836071  ...    1.102743    0.806057   49.693429
min       1.000000    0.000000    1.000000  ...    0.000000    0.000000    0.000000
25%     223.500000    0.000000    2.000000  ...    0.000000    0.000000    7.910400
50%     446.000000    0.000000    3.000000  ...    0.000000    0.000000   14.454200
75%     668.500000    1.000000    3.000000  ...    1.000000    0.000000   31.000000
max     891.000000    1.000000    3.000000  ...    8.000000    6.000000  512.329200
```

Program 2

```
# Imports the pandas module, used for data manipulation and analysis
import pandas
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
# Count the number of passengers in each class ordered by Pclass
class_passenger_count = titanic_data['Pclass'].value_counts().
reindex([1,2,3])
# Calculate the average age
average_age = titanic_data['Age'].mean()
# Calculate the number of survivors
number_of_survivors = titanic_data['Survived'].sum()
# Output the results
print("Number of passengers in each class")
print("---------------------------------")
print(class_passenger_count)
# Prints with precision 2 after decimal point
print("Average age of passengers:","%.2f" % average_age)
print("Number of survivors:", number_of_survivors)
```

Output

```
Number of passengers in each class
---------------------------------
Pclass
1    216
2    184
3    491
Name: count, dtype: int64
Average age of passengers: 29.70
Number of survivors: 342
```

3 - Handling Missing Data and Data Imputation in Python (Pandas)

Load the Titanic dataset.

1. Display all columns with missing values and the % of missing data.
2. Drop all rows where the Age is missing.
   Report the number of rows before and after.
3. (i) Impute missing Age with median.
   (ii) Impute missing Embarked with most frequent value (mode).
   (iii) Fill missing Cabin with a placeholder like "Unknown".

```
Program 1
---------
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Store the url of the titanic data set
url = 'https://raw.githubusercontent.com/datasciencedojo/datasets/master
/titanic.csv'
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv(url)

# Calculate missing values and percentage
missing_data = titanic_data.isnull().sum()
# len(titanic_data) returns the number of rows in the data frame
missing_percentage = (missing_data / len(titanic_data)) * 100

# Create a DataFrame to hold the missing data info
missing_info = pandas.DataFrame({'Missing Values': missing_data,
'Percentage': missing_percentage})

# Filter columns with missing values
missing_info = missing_info[missing_info['Missing Values'] > 0]

# Display the results
print(missing_info)

Output
------
```

	Missing Values	Percentage
Age	177	19.865320
Cabin	687	77.104377
Embarked	2	0.224467

Program 2

```
---------
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Store the url of the titanic data set
url = 'https://raw.githubusercontent.com/datasciencedojo/datasets/master/
titanic.csv'
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv(url)

# len(titanic_data) returns the number of rows in the data frame
# Get the number of rows before dropping
rows_before = len(titanic_data)

# Drop rows where 'Age' is missing
titanic_data_cleaned = titanic_data.dropna(subset=['Age'])

# Get the number of rows after dropping
rows_after = len(titanic_data_cleaned)

# Set options to display the full DataFrame, otherwise display will be
# truncated
pandas.set_option('display.max_rows', None)      # Show all rows
pandas.set_option('display.max_columns', None)   # Show all columns

# Display the results
print("Titanic data before dropping")
print("----------------------------")
print(titanic_data)
print("-----------------------------------")
print("Number of rows before dropping = ", rows_before)
print("-----------------------------------")
print("Titanic data after dropping")
print("---------------------------")
print(titanic_data_cleaned)
print("-----------------------------------")
print("Number of rows after dropping = ", rows_after)
print("-----------------------------------")
```

Output (Displaying data frames as truncated)

```
Titanic data before dropping
----------------------------
     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
890          891         0       3                                Dooley, Mr. Patrick    male  32.0      0      0            370376   7.7500   NaN        Q

[891 rows x 12 columns]
-----------------------------------
Number of rows before dropping =  891
-----------------------------------
Titanic data after dropping
---------------------------
     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
..           ...       ...     ...                                                ...     ...   ...    ...    ...               ...      ...   ...      ...
885          886         0       3                Rice, Mrs. William (Margaret Norton)  female  39.0      0      5            382652  29.1250   NaN        Q
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
889          890         1       1                              Behr, Mr. Karl Howell    male  26.0      0      0            111369  30.0000  C148        C
890          891         0       3                                Dooley, Mr. Patrick    male  32.0      0      0            370376   7.7500   NaN        Q

[714 rows x 12 columns]
-----------------------------------
Number of rows after dropping =  714
-----------------------------------
```

Program 3(i)

```
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Store the url of the titanic data set
url = 'https://raw.githubusercontent.com/datasciencedojo/datasets/master
/titanic.csv'
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv(url)

# Set options to display the full DataFrame, otherwise display will be
# truncated
pandas.set_option('display.max_rows', None)       # Show all rows
pandas.set_option('display.max_columns', None)    # Show all columns

# Display the results
print("Titanic data before imputing Age")
print("--------------------------------")
print(titanic_data)
```

```
print("-------------------------------------")

# Calculate the median age
median_age = titanic_data['Age'].median()

# Impute missing values with the median age
# inplace=True modifies the original data frame
# inplace=False creates a new data frame with changes applied
titanic_data['Age'].fillna(median_age, inplace=True)

# Display the results
print("Titanic data after imputing Age")
print("--------------------------------")
print(titanic_data)
print("-------------------------------------")

Output ( Displaying data frames as truncated )
-----------------------------------------------
```

```
Titanic data before imputing Age
--------------------------------
     PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0              1         0       3  ...   7.2500   NaN         S
1              2         1       1  ...  71.2833   C85         C
2              3         1       3  ...   7.9250   NaN         S
3              4         1       1  ...  53.1000  C123         S
4              5         0       3  ...   8.0500   NaN         S
..           ...       ...     ...  ...      ...   ...       ...
886          887         0       2  ...  13.0000   NaN         S
887          888         1       1  ...  30.0000   B42         S
888          889         0       3  ...  23.4500   NaN         S
889          890         1       1  ...  30.0000  C148         C
890          891         0       3  ...   7.7500   NaN         Q

[891 rows x 12 columns]
------------------------------------
Titanic data after imputing Age
--------------------------------
     PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0              1         0       3  ...   7.2500   NaN         S
1              2         1       1  ...  71.2833   C85         C
2              3         1       3  ...   7.9250   NaN         S
3              4         1       1  ...  53.1000  C123         S
4              5         0       3  ...   8.0500   NaN         S
..           ...       ...     ...  ...      ...   ...       ...
886          887         0       2  ...  13.0000   NaN         S
887          888         1       1  ...  30.0000   B42         S
888          889         0       3  ...  23.4500   NaN         S
889          890         1       1  ...  30.0000  C148         C
890          891         0       3  ...   7.7500   NaN         Q

[891 rows x 12 columns]
```

Program 3(ii)

```
-------------
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Store the url of the titanic data set
url = 'https://raw.githubusercontent.com/datasciencedojo/datasets/master
```

```
/titanic.csv'
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv(url)

# Set options to display the full DataFrame, otherwise display will be
# truncated
pandas.set_option('display.max_rows', None)      # Show all rows
pandas.set_option('display.max_columns', None)   # Show all columns

# Display the results
print("Titanic data before imputing Embarked")
print("-------------------------------------")
print(titanic_data)
print("-------------------------------------")

# Calculate the mode for the 'Embarked' column
# Get the first mode value, as mode() can return multiple values

mode_embarked = titanic_data['Embarked'].mode()[0]

# Impute missing embarked with the most frequent value
titanic_data['Embarked'].fillna(mode_embarked, inplace=True)

# Display the results
print("Titanic data after imputing Embarked")
print("------------------------------------")
print(titanic_data)
print("------------------------------------")

Output ( Displaying data frames as truncated )
-----------------------------------------------
```

```
Titanic data before imputing Embarked
-------------------------------------
     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
890          891         0       3                                Dooley, Mr. Patrick    male  32.0      0      0            370376   7.7500   NaN        Q

[891 rows x 12 columns]
-------------------------------------
Titanic data after imputing Embarked
-------------------------------------
     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
890          891         0       3                                Dooley, Mr. Patrick    male  32.0      0      0            370376   7.7500   NaN        Q

[891 rows x 12 columns]
-------------------------------------
```

Program 3(iii)

```
--------------
# Imports the pandas module, used for data manipulation and analysis
import pandas

# Store the url of the titanic data set
url = 'https://raw.githubusercontent.com/datasciencedojo/datasets/master
/titanic.csv'
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv(url)

# Set options to display the full DataFrame, otherwise display will be
# truncated
pandas.set_option('display.max_rows', None)       # Show all rows
pandas.set_option('display.max_columns', None)    # Show all columns

# Display the results
print("Titanic data before imputing Cabin")
print("-------------------------------------")
print(titanic_data)
print("-------------------------------------")


# Fill missing values in 'Cabin' with the placeholder 'Unknown'
titanic_data['Cabin'].fillna('Unknown', inplace=True)

# Display the results
```

```
print("Titanic data after imputing Cabin")
print("---------------------------------")
print(titanic_data)
print("-----------------------------------------")

Output ( Displaying data frames as truncated )
-----------------------------------------------
```

```
Titanic data before imputing Cabin
----------------------------------
     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
890          891         0       3                                Dooley, Mr. Patrick    male  32.0      0      0            370376   7.7500   NaN        Q

[891 rows x 12 columns]
-----------------------------------
Titanic data after imputing Cabin
---------------------------------
     PassengerId  Survived  Pclass                                               Name     Sex  ...  Parch            Ticket     Fare    Cabin  Embarked
0              1         0       3                            Braund, Mr. Owen Harris    male  ...      0         A/5 21171   7.2500  Unknown         S
1              2         1       1  Cumings, Mrs. John Bradley (Florence Briggs Th...  female  ...      0          PC 17599  71.2833      C85         C
2              3         1       3                             Heikkinen, Miss. Laina  female  ...      0  STON/O2. 3101282   7.9250  Unknown         S
3              4         1       1       Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  ...      0            113803  53.1000     C123         S
4              5         0       3                           Allen, Mr. William Henry    male  ...      0            373450   8.0500  Unknown         S
..           ...       ...     ...                                                ...     ...  ...    ...               ...      ...      ...       ...
886          887         0       2                             Montvila, Rev. Juozas    male  ...      0            211536  13.0000  Unknown         S
887          888         1       1                      Graham, Miss. Margaret Edith  female  ...      0            112053  30.0000      B42         S
888          889         0       3          Johnston, Miss. Catherine Helen "Carrie"  female  ...      2        W./C. 6607  23.4500  Unknown         S
889          890         1       1                              Behr, Mr. Karl Howell    male  ...      0            111369  30.0000     C148         C
890          891         0       3                                Dooley, Mr. Patrick    male  ...      0            370376   7.7500  Unknown         Q

[891 rows x 12 columns]
-----------------------------------
```

9 - Univariate and Bivariate Analysis

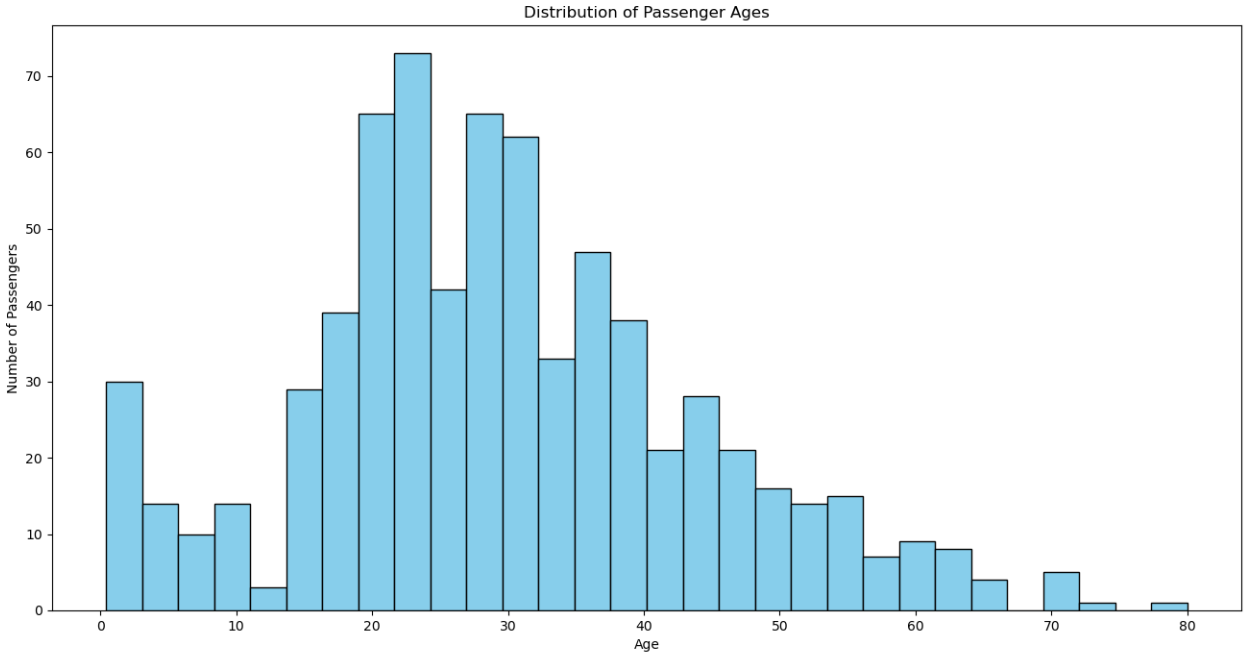
Using the titanic data set :

1. Find out
   (a) What is the distribution of passenger ages?
   (b) What is the most common passenger class?
2. Analyze the relationship between Survived and Sex using a bar chart. What inference can you make?
3. How is the fare distributed across different passenger classes? Which class has the highest median fare?

```
Program 1(a)
------------
```

```
# Imports the pandas module, used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot
# various figures
from matplotlib import pyplot
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
# Plotting the distribution of passenger ages using a histogram
titanic_data['Age'].plot(kind='hist', color='skyblue', edgecolor="black",
bins=30)
# sets the title
pyplot.title('Distribution of Passenger Ages')
# sets the x-axis label
pyplot.xlabel('Age')
# sets the y-axis label
pyplot.ylabel('Number of Passengers')
# shows the histogram
pyplot.show()
```

Output



Program 1(b)

```
# Imports the pandas module, used for data manipulation and analysis
import pandas
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
# Calculating the most common passenger class
# mode()[0] get the first mode value, as mode() can return multiple values
most_common_class = titanic_data['Pclass'].mode()[0]
# Display the result
print("Most common passenger class:", most_common_class)
```

Output

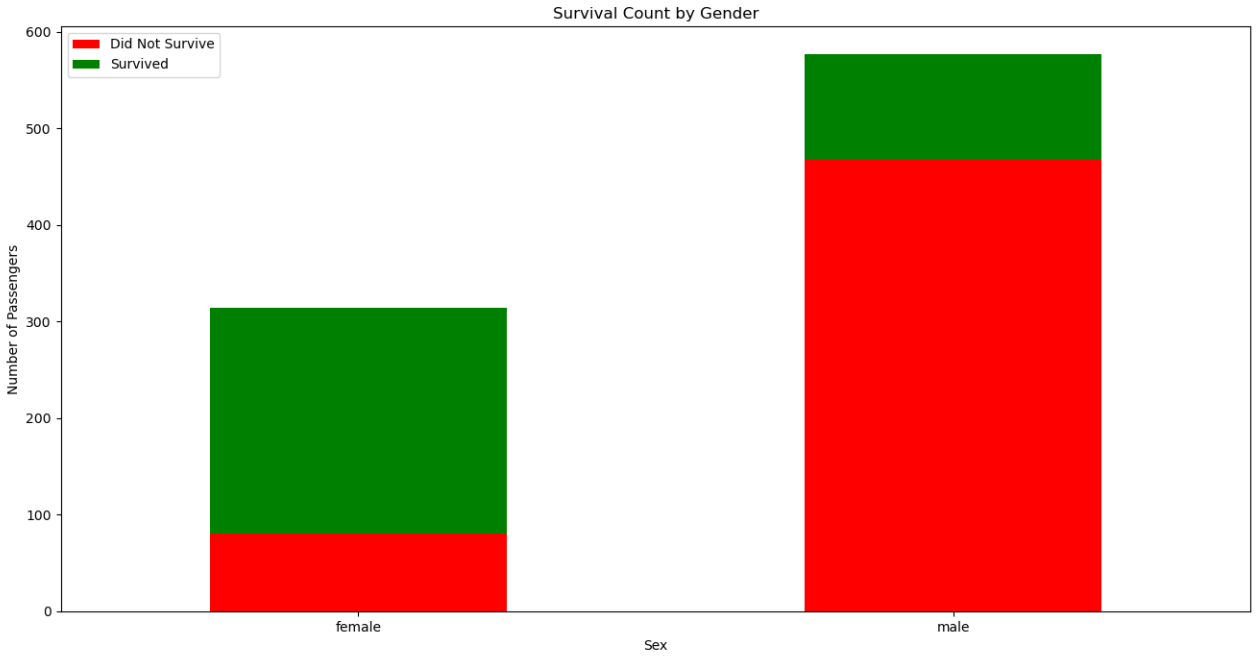
```
Most common passenger class: 3
```

Program 2

```
# Imports the pandas module, used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
# Count the number of survivors and non-survivors by sex
# The groupby() function groups the data by "Sex" and "Survived"
# size() counts the occurrences
# The resulting counts are unstacked to create a Data Frame suitable for
# plotting
survival_sex = titanic_data.groupby(['Sex', 'Survived']).size().unstack()
# Plotting the bar chart as a stacked one
survival_sex.plot(kind='bar', stacked=True, color=['red', 'green'])
# sets the title
pyplot.title('Survival Count by Gender')
# sets the x-axis label
pyplot.xlabel('Sex')
# sets the y-axis label
pyplot.ylabel('Number of Passengers')
# displays x-axis tick labels horizontally (default behaviour is vertical)
pyplot.xticks(rotation='horizontal')
# sets the legend
```

```
pyplot.legend(['Did Not Survive', 'Survived'])
# shows the bar chart
pyplot.show()
```

Output



Inference

During the Titanic evacuation, women were favored compared to men, as lifeboats were prioritised for women

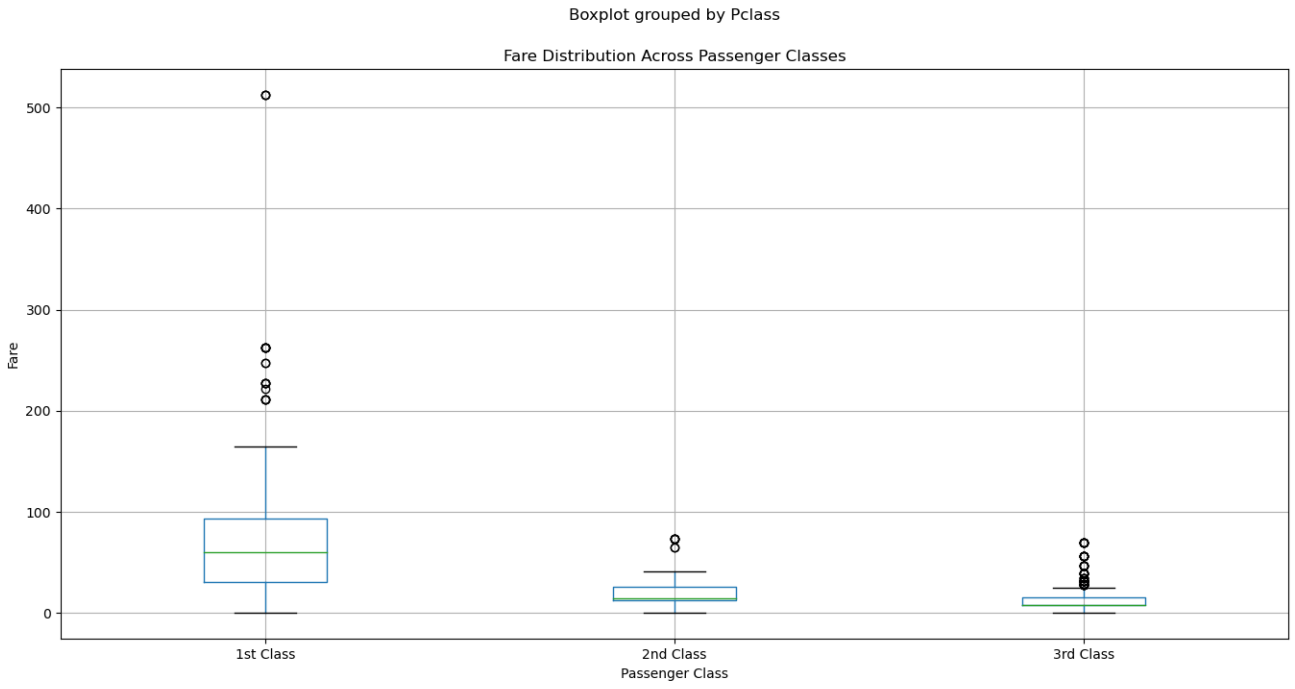
Program 3

```
# Imports the pandas module, used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
```

```
# Plotting the distribution of fares
titanic_data.boxplot(column='Fare', by='Pclass')
# sets the title
pyplot.title('Fare Distribution Across Passenger Classes')
# sets the x-axis label
pyplot.xlabel('Passenger Class')
# sets the y-axis label
pyplot.ylabel('Fare')
# sets x-axis ticks along with labels
pyplot.xticks([1, 2, 3],['1st Class', '2nd Class', '3rd Class'])
# shows the plot
pyplot.show()
# Calculate the median fare for each passenger class
median_fare_by_class = titanic_data.groupby('Pclass')['Fare'].median()
# idxmax() is used to find the index (i.e., the class number) of the
# maximum median fare
print("Passenger Class with highest median fare:", median_fare_by_class.
idxmax())
```

Output

```
------
```

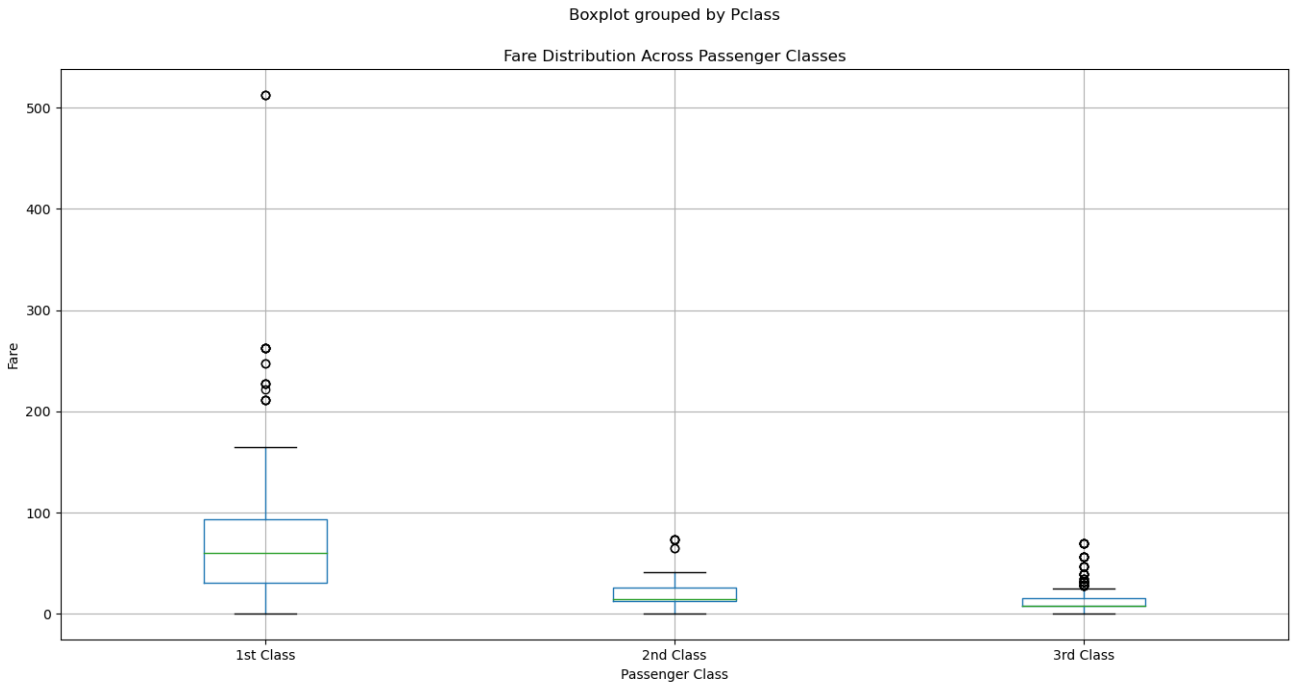


```
Passenger Class with highest median fare: 1
```

10 - Applying Advanced EDA Techniques: Boxplots, Violin Plots

1. Using the Titanic dataset:
   (a) Create a boxplot to compare fares across passenger classes
   (b) What does the spread tell you?
2. Visualise age distribution across survival status using a violin plot. What patterns do you observe?

```
Program 1
---------
# Imports the pandas module, used for data manipulation and analysis
import pandas
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Load Titanic dataset into a data frame
titanic_data = pandas.read_csv('titanic.csv')
# Plotting the distribution of fares
titanic_data.boxplot(column='Fare', by='Pclass')
# sets the title
pyplot.title('Fare Distribution Across Passenger Classes')
# sets the x-axis label
pyplot.xlabel('Passenger Class')
# sets the y-axis label
pyplot.ylabel('Fare')
# sets x-axis ticks along with labels
pyplot.xticks([1, 2, 3],['1st Class', '2nd Class', '3rd Class'])
# shows the plot
pyplot.show()

Output
------
```



Description of Boxplot

1. Here the box indicates range of values from Q1 to Q3.
2. The green line within the box represents Q2 or median.
3. The 2 horizontal lines outside the box are called whiskers.
4. Inter Quartile Range (IQR) = Q3 - Q1.
5. The lower whisker can extend upto Q1 - 1.5 * IQR.
6. The upper whisker can extend upto Q3 + 1.5 * IQR.
7. Outliers are data outside the whiskers.
8. They represent significantly lower or higher values.

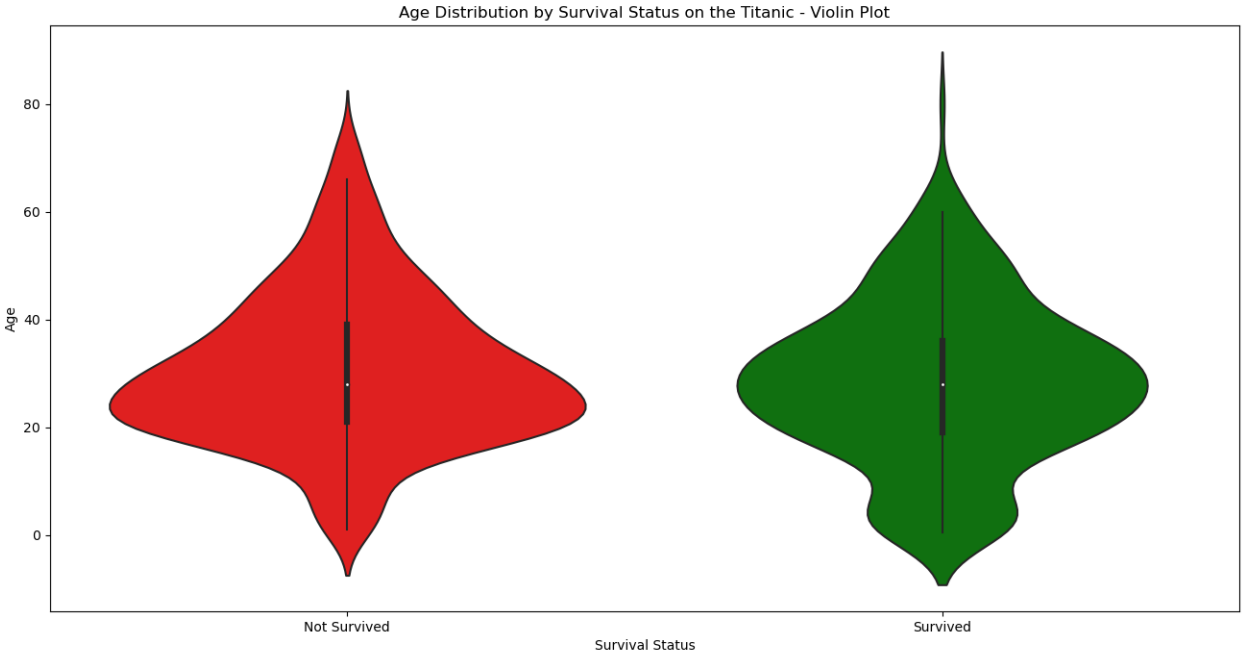
Analysis of Spread

1. The term **Spread** refers to the range and distribution of data values in a data set.
2. During analysis we can see that first class fares are higher with large variability.
3. Second class fares are moderate with less variability.
4. Third class fares are lowest with less variability.

Program 2

```
# imports the pandas module, used for data manipulation and analysis
import pandas
# imports the data visualisation library seaborn
import seaborn
# imports pyplot, a module used in the package matplotlib to plot various
# figures
from matplotlib import pyplot
# Load Titanic dataset into a data frame
titanic = pandas.read_csv('titanic.csv')
# Clean the data by dropping rows with missing age values
titanic = titanic.dropna(subset=['Age'])
# Create a violin plot
seaborn.violinplot(x='Survived', y='Age', data=titanic,
palette={0: 'red', 1: 'green'})
# Set titles and labels
pyplot.title('Age Distribution by Survival Status on the Titanic - Violin
Plot')
pyplot.xticks([0, 1], ['Not Survived', 'Survived'])
pyplot.xlabel('Survival Status')
pyplot.ylabel('Age')
# Show the plot
pyplot.show()
```

Output



Analysis of Patterns

1. Children and older adults had higher survival rates.
2. Young adults had lower survival rates.