## Section B – Practical Questions (Code + Output)

# 1. CSV Data Exploration & Visualization

1. Load & Inspect

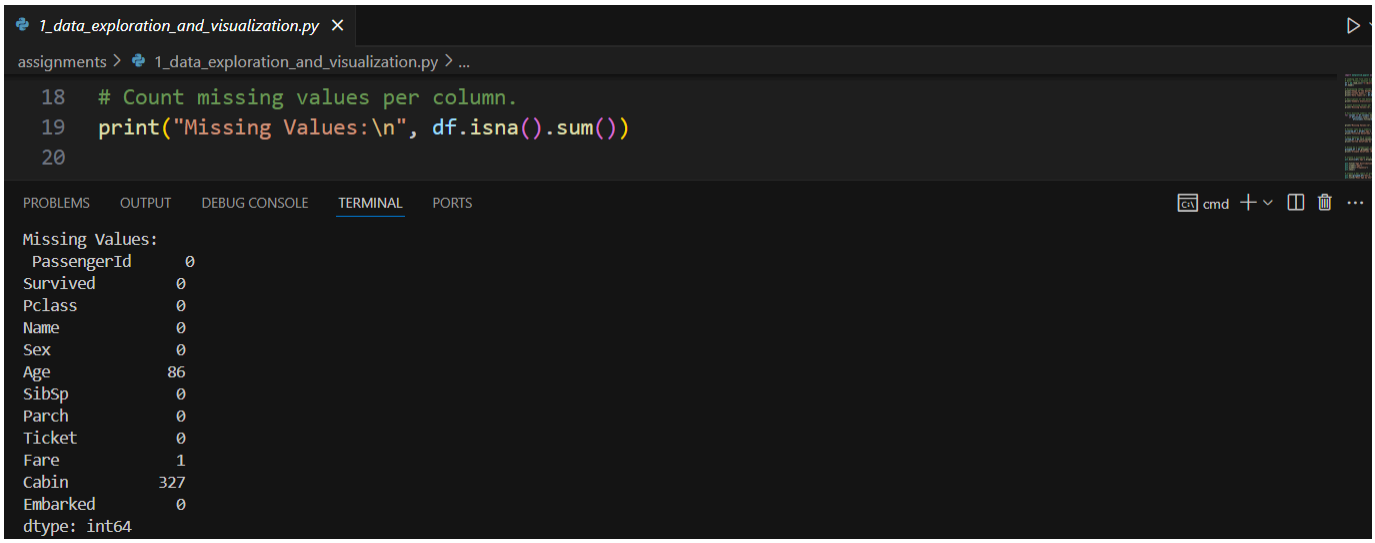
```python
# Importing necessary libraries
import pandas as pd
import matplotlib.pyplot as plt

# Loading CSV file into a dataframe and showing the first 10 rows
# Note: Titanic dataset used here is downloaded from kaggle dataset repository
df = pd.read_csv(r"C:\Users\devar\Documents\Dotkonnekt\genai-workshop\week2\data\titanic.csv")
df.head()

# Displaying shape, column names, and data types.
print("Shape of the DataFrame:", df.shape)
print("Column Names:", df.columns.tolist())
print("Data Types:\n", df.dtypes)
```

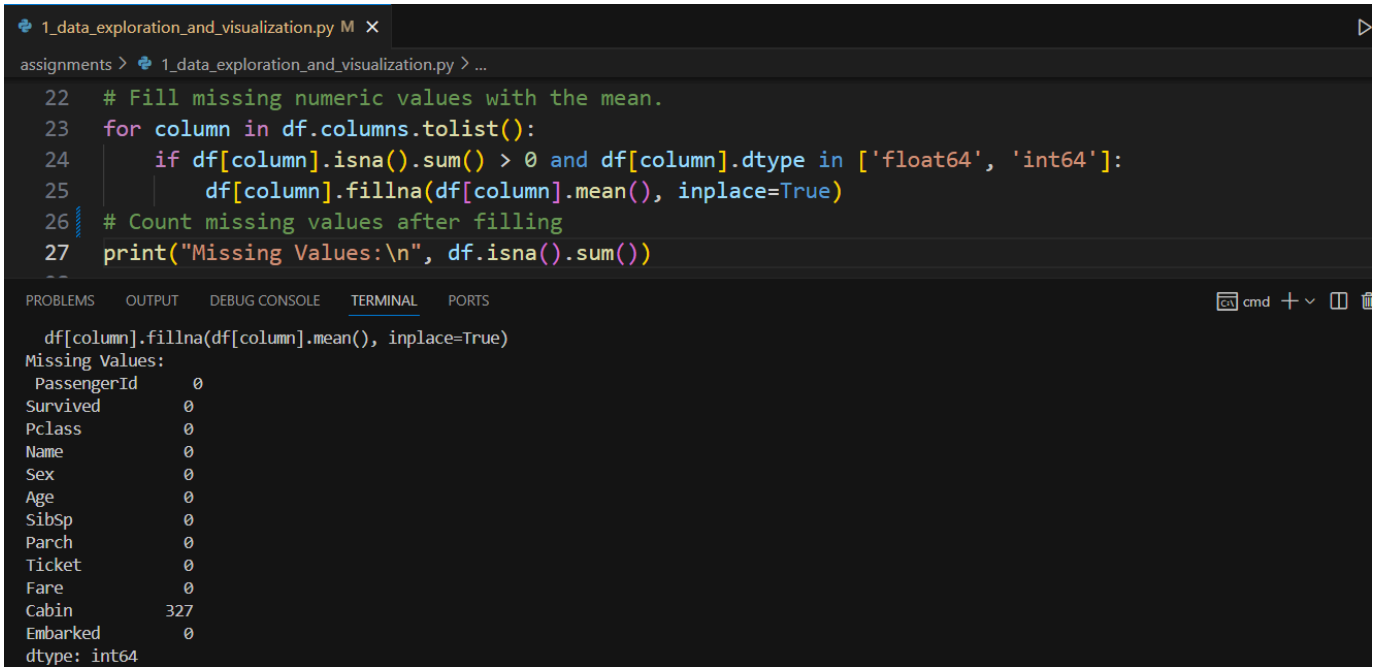
```
(env) C:\Users\devar\Documents\Dotkonnekt\genai-workshop\week2\assignments>python 1_data_exploration_and_visualization.py
Shape of the DataFrame: (418, 12)
Column Names: ['PassengerId', 'Survived', 'Pclass', 'Name', 'Sex', 'Age', 'SibSp', 'Parch', 'Ticket', 'Fare', 'Cabin', 'Embarked']
Data Types:
 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
```

2. Summary Statistics

```python
# Description of the dataset
print("Summary Statistics:\n", df.describe())
```

```
Summary Statistics:
       PassengerId    Survived      Pclass         Age       SibSp       Parch        Fare
count   418.000000  418.000000  418.000000  332.000000  418.000000  418.000000  417.000000
mean   1100.500000    0.363636    2.265550   30.272590    0.447368    0.392344   35.627188
std     120.810458    0.481622    0.841838   14.181209    0.896760    0.981429   55.907576
min     892.000000    0.000000    1.000000    0.170000    0.000000    0.000000    0.000000
25%     996.250000    0.000000    1.000000   21.000000    0.000000    0.000000    7.895800
50%    1100.500000    0.000000    3.000000   27.000000    0.000000    0.000000   14.454200
75%    1204.750000    1.000000    3.000000   39.000000    1.000000    0.000000   31.500000
max    1309.000000    1.000000    3.000000   76.000000    8.000000    9.000000  512.329200
```




3. Filter & Sort

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
29  # Filter rows by a numeric condition (e.g., Age > 30)
30  filtered_df = df[df['Age'] > 30]
31  print("Filtered DataFrame (Age > 30):\n", filtered_df.head())
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
Filtered DataFrame (Age > 30):
     PassengerId  Survived  Pclass                                          Name     Sex      Age  SibSp  Parch  Ticket     Fare Cabin Embarked
0            892         0       3                              Kelly, Mr. James    male  34.50000      0      0  330911   7.8292   NaN        Q
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
2            894         0       2                     Myles, Mr. Thomas Francis    male  62.00000      0      0  240276   9.6875   NaN        Q
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
2            894         0       2                     Myles, Mr. Thomas Francis    male  62.00000      0      0  240276   9.6875   NaN        Q
10           902         0       3                            Ilieff, Mr. Ylio    male  30.27259      0      0  349220   7.8958   NaN        S
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
2            894         0       2                     Myles, Mr. Thomas Francis    male  62.00000      0      0  240276   9.6875   NaN        Q
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
2            894         0       2                     Myles, Mr. Thomas Francis    male  62.00000      0      0  240276   9.6875   NaN        Q
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
1            893         1       3              Wilkes, Mrs. James (Ellen Needs)  female  47.00000      1      0  363272   7.0000   NaN        S
2            894         0       2                     Myles, Mr. Thomas Francis    male  62.00000      0      0  240276   9.6875   NaN        Q
10           902         0       3                            Ilieff, Mr. Ylio    male  30.27259      0      0  349220   7.8958   NaN        S
11           903         0       1                        Jones, Mr. Charles Cresson    male  46.00000      0      0     694  26.0000   NaN        S
```

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
33  # Sort dataset by a column in descending order (eg. PassengerId).
34  sorted_df = df.sort_values(by = 'PassengerId', ascending = False)
35  print("Sorted DataFrame by PassengerId (Descending):\n", sorted_df.head())
36
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
Sorted DataFrame by PassengerId (Descending):
     PassengerId  Survived  Pclass                          Name     Sex  ...  Parch            Ticket     Fare Cabin  Embarked
417         1309         0       3      Peter, Master. Michael J    male  ...      1              2668  22.3583   NaN         C
416         1308         0       3           Ware, Mr. Frederick    male  ...      0            359309   8.0500   NaN         S
     PassengerId  Survived  Pclass                          Name     Sex  ...  Parch            Ticket     Fare Cabin  Embarked
417         1309         0       3      Peter, Master. Michael J    male  ...      1              2668  22.3583   NaN         C
416         1308         0       3           Ware, Mr. Frederick    male  ...      0            359309   8.0500   NaN         S
417         1309         0       3      Peter, Master. Michael J    male  ...      1              2668  22.3583   NaN         C
416         1308         0       3           Ware, Mr. Frederick    male  ...      0            359309   8.0500   NaN         S
415         1307         0       3  Saether, Mr. Simon Sivertsen    male  ...      0  SOTON/O.Q. 3101262   7.2500   NaN         S
414         1306         1       1  Oliva y Ocana, Dona. Fermina  female  ...      0          PC 17758  108.9000  C105         C
413         1305         0       3            Spector, Mr. Woolf    male  ...      0         A.5. 3236   8.0500   NaN         S
```

4. Group & Aggregate

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
38  # Group by a categorical column, calculate mean of a numeric column ()
39  grouped_df = df.groupby("Sex")["Age"].mean().reset_index()
40  print("Grouped DataFrame (Mean Age):\n", grouped_df)
41
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
Grouped DataFrame (Mean Age):
      Sex        Age
0  female  30.272400
1    male  30.272699
```

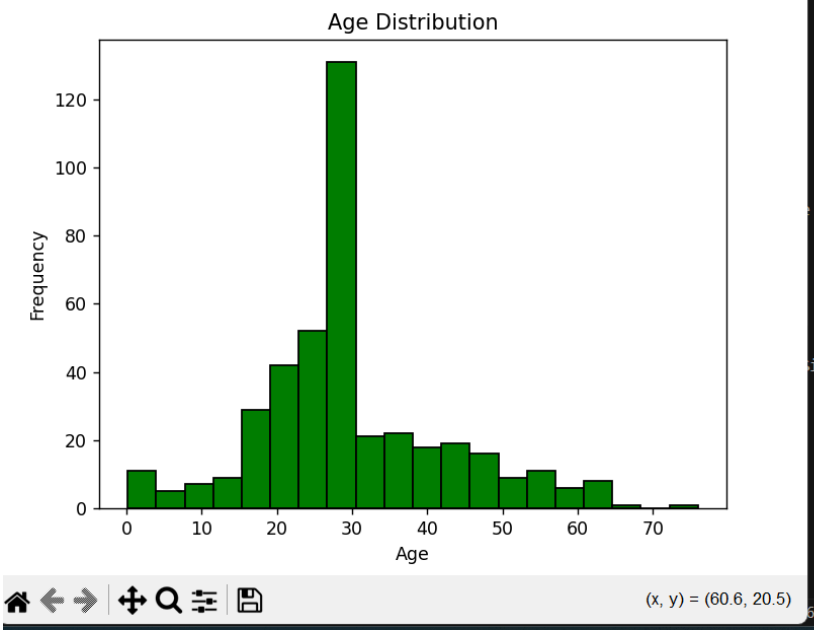
5. Visualize

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
43  # Create a histogram for a numeric column
44  plt.hist(x=df['Age'].dropna(), bins=20, color='green', edgecolor='black')  # dropna to avoid NaN
    issues
45  plt.title("Age Distribution")
46  plt.xlabel("Age")
47  plt.ylabel("Frequency")
48  plt.show()
```

Figure 1




(x, y) = (60.6, 20.5)

python

```
  SibSp  Parch  Ticket     Fare Cabin Embarked
      0      0  330911   7.8292   NaN        Q
      1      0  363272   7.0000   NaN        S
      0      0  240276   9.6875   NaN        Q
      0      0  349220   7.8958   NaN        S
      0      0     694  26.0000   NaN        S

ibSp  Parch             Ticket      Fare Cabin Embarked
   1      1               2668   22.3583   NaN        C
   0      0             359309    8.0500   NaN        S
   0      0  SOTON/O.Q. 3101262    7.2500   NaN        S
   0      0           PC 17758  108.9000  C105        C
   0      0          A.5. 3236    8.0500   NaN        S
```

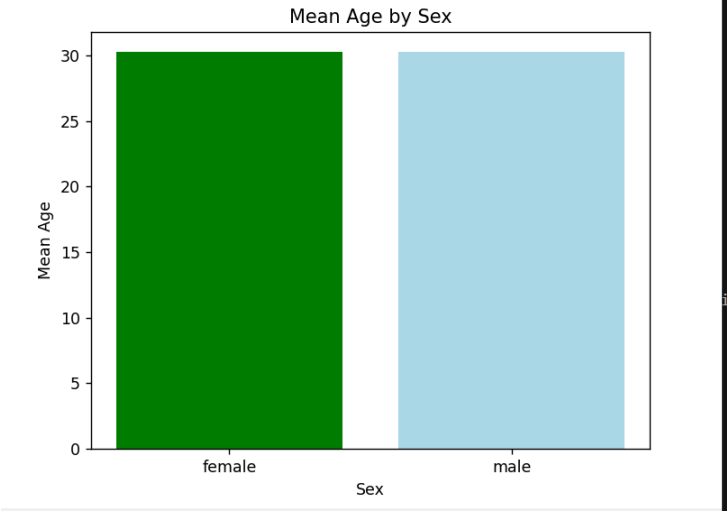
6 minutes ago) Ln 45, Col 1 Spaces: 4 UTF-8 CRLF {} Python 3.1

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
50  # Create a bar chart of group averages
51  plt.bar(grouped_df["Sex"], grouped_df["Age"], color=["green", "lightblue"])
52  plt.title("Mean Age by Sex")
53  plt.xlabel("Sex")
54  plt.ylabel("Mean Age")
55  plt.show()
```

Figure 1




(x, y) = (male, 5.71)

python

```
  SibSp  Parch  Ticket     Fare Cabin Embarked
      0      0  330911   7.8292   NaN        Q
      1      0  363272   7.0000   NaN        S
      0      0  240276   9.6875   NaN        Q
      0      0  349220   7.8958   NaN        S
      0      0     694  26.0000   NaN        S

ibSp  Parch             Ticket      Fare Cabin Embark
   1      1               2668   22.3583   NaN
   0      0             359309    8.0500   NaN
   0      0  SOTON/O.Q. 3101262    7.2500   NaN
   0      0           PC 17758  108.9000  C105
   0      0          A.5. 3236    8.0500   NaN
```

6. Extra Challenge: Save the cleaned dataset as processed_data.csv.

1_data_exploration_and_visualization.py M

assignments > 1_data_exploration_and_visualization.py > ...

```
56
57
58  # Save the cleaned dataset as processed_data.csv
59  df.to_csv(r"C:\Users\devar\Documents\Dotkonnekt\genai-workshop\week2\data\processed_titanic.csv",
    index=False)
60
61
```

## 2. Decision Tree Classifier

2_decision_tree_classifier.py M

assignments > 2_decision_tree_classifier.py > ...

```
1   # Import necessary libraries
2   from sklearn.datasets import load_iris
3   from sklearn.tree import DecisionTreeClassifier, plot_tree
4   from sklearn.model_selection import train_test_split
5   from sklearn.metrics import accuracy_score
6   import matplotlib.pyplot as plt
7
8   # Load the Iris dataset
9   iris = load_iris()
10  X = iris.data
11  y = iris.target
12
13  # Split into training and testing sets (80% train, 20% test)
14  X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
15
16  # Create and train the Decision Tree Classifier
17  clf = DecisionTreeClassifier(random_state=42)
18  clf.fit(X_train, y_train)
19
20  # Predict on the test set
21  y_pred = clf.predict(X_test)
22
23  # Calculate accuracy
24  accuracy = accuracy_score(y_test, y_pred)
25  print(f"Accuracy: {accuracy:.2f}")
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS python

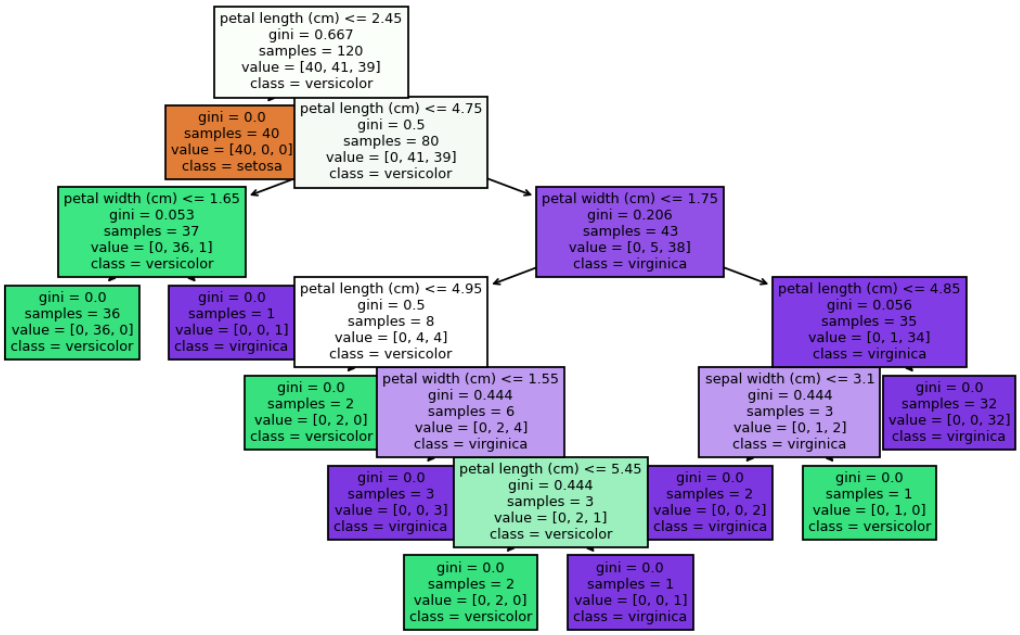
```
Accuracy: 1.00
```

2_decision_tree_classifier.py M

assignments > 2_decision_tree_classifier.py > ...

```
26
27  # Plot the Decision Tree
28  plt.figure(figsize=(12, 8))
29  plot_tree(clf, filled=True, feature_names=iris.feature_names, class_names=iris.target_names)
30  plt.show()
```

Figure 1




## 3. Text Processing with NLTK

3_text_processing_with_nltk.py M

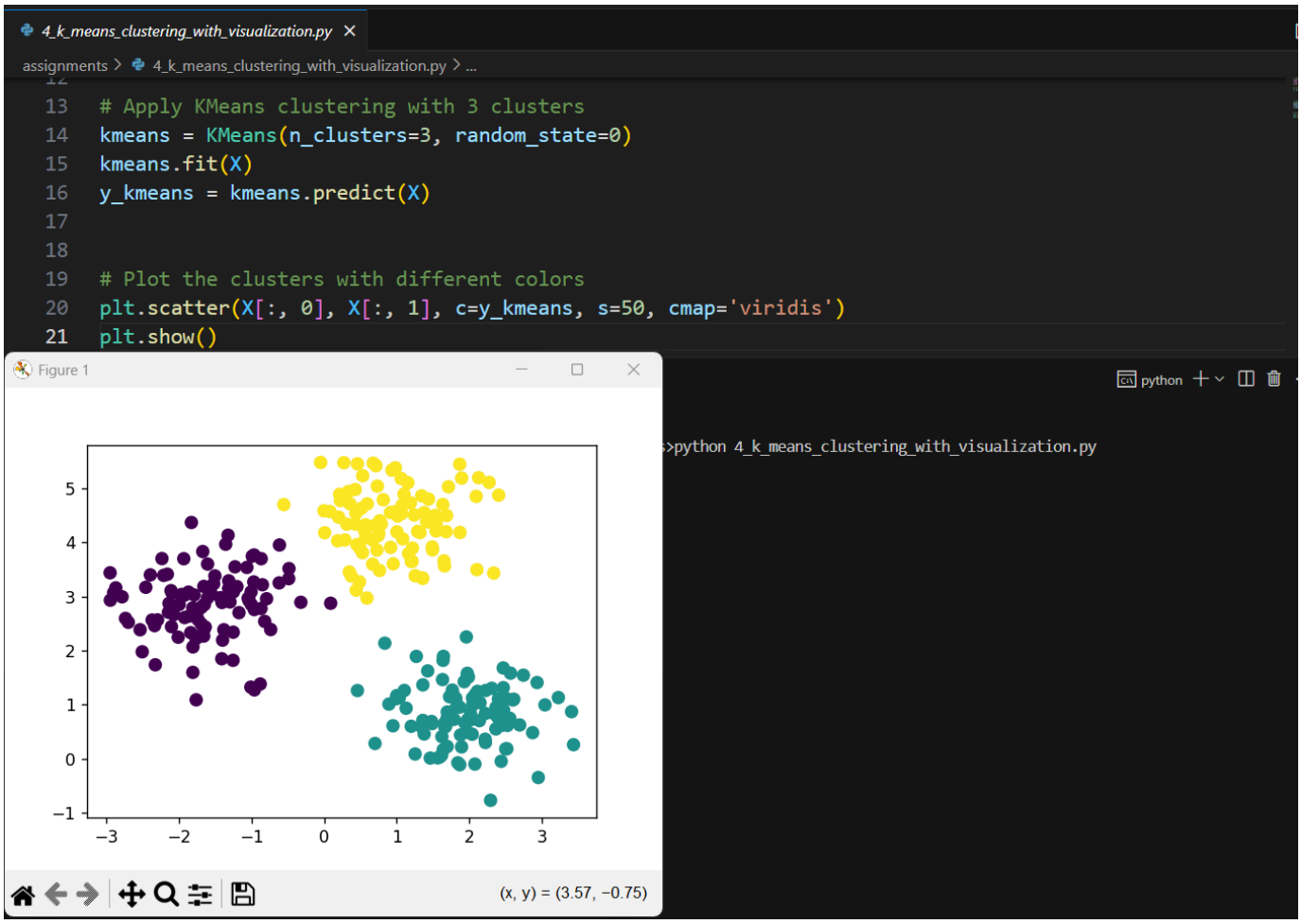
assignments > 3_text_processing_with_nltk.py > ...

```
35  # Output results
36  print("Original Tokens:", tokens)
37  print("Filtered Tokens (No Stopwords):", filtered_tokens)
38  print("POS Tags:", pos_tags)
39  print(f"Number of Nouns: {num_nouns}")
40  print(f"Number of Verbs: {num_verbs}")
41  print(f"Number of Adjectives: {num_adjectives}")
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
Filtered Tokens (No Stopwords): ['enthralling', 'draw', 'trophy', 'England', 'India', 'provided', 'dramatic', 'start', 'new', 'World', 'Test', 'Championship', 'cycle', 'epic', 'contest', 'five', 'Tests', 'going', 'final', 'day', 'four', 'fact', 'final', 'session', 'providing', 'best', 'individual', 'collective', 'performances', 'format', 'seen', 'recent', 'years']
POS Tags: [('enthralling', 'VBG'), ('draw', 'JJ'), ('trophy', 'NN'), ('England', 'NNP'), ('India', 'NNP'), ('provided', 'VBD'), ('dramatic', 'JJ'), ('start', 'RB'), ('new', 'JJ'), ('World', 'NNP'), ('Test', 'NNP'), ('Championship', 'NNP'), ('cycle', 'NN'), ('epic', 'NN'), ('contest', 'NN'), ('five', 'CD'), ('Tests', 'NNS'), ('going', 'VBG'), ('final', 'JJ'), ('day', 'NN'), ('four', 'CD'), ('fact', 'NN'), ('final', 'JJ'), ('session', 'NN'), ('providing', 'VBG'), ('best', 'JJS'), ('individual', 'JJ'), ('collective', 'NN'), ('performances', 'NNS'), ('format', 'VBP'), ('seen', 'VBN'), ('recent', 'JJ'), ('years', 'NNS')]
Number of Nouns: 16
Number of Verbs: 6
Number of Adjectives: 8
```

## 4. K-Means Clustering with Visualization



## 5. Confusion Matrix Plot

```python
# Predict
y_pred = clf.predict(X_test)

# Compute confusion matrix
cm = confusion_matrix(y_test, y_pred, labels=clf.classes_)

# Plot confusion matrix
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=iris.target_names)
disp.plot(cmap=plt.cm.Blues)
plt.title("Confusion Matrix - Decision Tree on Iris")
plt.show()
```