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# Practical Assignment 1 - Data Visualization using Python
# Dataset: Iris Dataset (UCI Machine Learning Repository)
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# Step 1: Import Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.datasets import load_iris
import plotly.express as px
```

```
# Step 2: Load Dataset
iris_data = load_iris()
df = pd.DataFrame(data=iris_data.data, columns=iris_data.feature_names)
df['species'] = pd.Categorical.from_codes(iris_data.target, iris_data.target_names)
df.head()
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

```
# Step 3: Check data info
print(df.info())
print(df.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column             Non-Null Count  Dtype   
---  ------             --------------  -----   
 0   sepal length (cm)  150 non-null    float64 
 1   sepal width (cm)   150 non-null    float64 
 2   petal length (cm)  150 non-null    float64 
 3   petal width (cm)   150 non-null    float64 
 4   species            150 non-null    category
dtypes: category(1), float64(4)
memory usage: 5.1 KB
None
       sepal length (cm)  sepal width (cm)  petal length (cm)  \
count         150.000000        150.000000         150.000000   
mean            5.843333          3.057333           3.758000   
std             0.828066          0.435866           1.765298   
min             4.300000          2.000000           1.000000   
25%             5.100000          2.800000           1.600000   
50%             5.800000          3.000000           4.350000   
75%             6.400000          3.300000           5.100000   
max             7.900000          4.400000           6.900000   

       petal width (cm)  
count        150.000000  
mean           1.199333  
std            0.762238  
min            0.100000  
25%            0.300000  
50%            1.300000  
75%            1.800000  
max            2.500000  
```

```
# Step 4: Handle Missing Values (Iris has none)
print("\nMissing Values:\n", df.isnull().sum())
```

```
Missing Values:
 sepal length (cm)    0
sepal width (cm)     0
petal length (cm)    0
petal width (cm)     0
species              0
dtype: int64
```

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# ------------------------------------------------------------
# Step 5: Visualization Techniques
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sns.set(style="whitegrid")
plt.figure(figsize=(6,4))
```
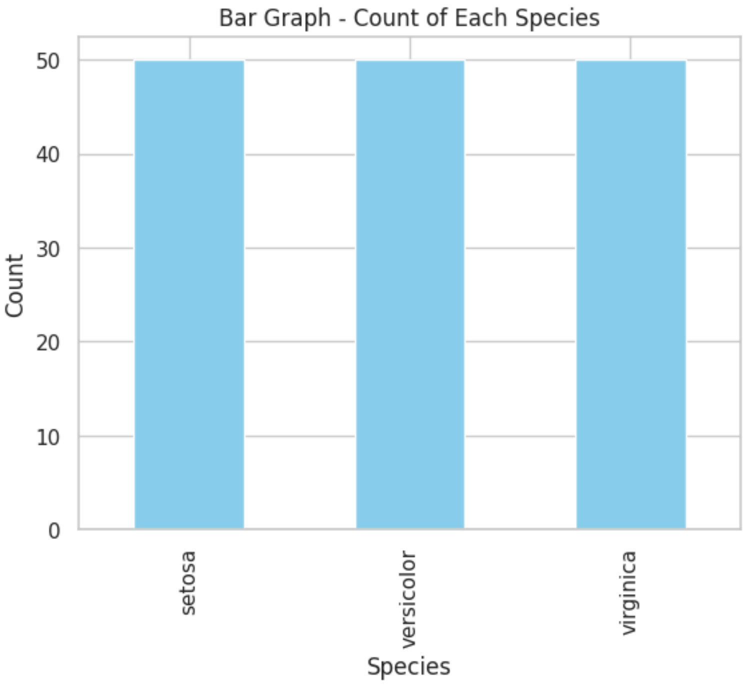

```
<Figure size 600x400 with 0 Axes>
<Figure size 600x400 with 0 Axes>
```

```
# a) Bar Graph
species_count = df['species'].value_counts()
species_count.plot(kind='bar', color='skyblue')
plt.title('Bar Graph - Count of Each Species')
plt.xlabel('Species')
plt.ylabel('Count')
plt.show()
```



```
# b) Histogram
plt.figure(figsize=(6,4))
plt.hist(df['sepal length (cm)'], bins=15, color='purple', alpha=0.7)
plt.title('Histogram - Sepal Length Distribution')
plt.xlabel('Sepal Length (cm)')
plt.ylabel('Frequency')
plt.show()
```

```
# c) Boxplot
plt.figure(figsize=(6,4))
sns.boxplot(x='species', y='petal length (cm)', data=df)
plt.title('Boxplot - Petal Length by Species')
plt.show()
```

```
# d) Scatter Plot
plt.figure(figsize=(6,4))
sns.scatterplot(x='sepal length (cm)', y='petal length (cm)', hue='species', data=df)
plt.title('Scatter Plot - Sepal vs Petal Length')
plt.show()
```

```
# e) Line Plot
plt.figure(figsize=(6,4))
for species in df['species'].unique():
    subset = df[df['species'] == species]
    plt.plot(subset.index, subset['sepal length (cm)'], label=species)
plt.legend()
plt.title('Line Plot - Sepal Length Trend by Species')
plt.xlabel('Index')
plt.ylabel('Sepal Length (cm)')
plt.show()
```

```
# f) Pair Plot
sns.pairplot(df, hue='species')
plt.suptitle('Pair Plot - Scatterplot Matrix', y=1.02)
plt.show()
```

```
# g) Heatmap (Correlation)
plt.figure(figsize=(6,4))
sns.heatmap(df.drop(columns='species').corr(), annot=True, cmap='coolwarm')
plt.title('Heatmap - Feature Correlation')
plt.show()
```

```
# h) Violin Plot
plt.figure(figsize=(6,4))
sns.violinplot(x='species', y='sepal width (cm)', data=df)
plt.title('Violin Plot - Sepal Width by Species')
plt.show()
```

```
# i) Joint Plot
sns.jointplot(x='sepal length (cm)', y='petal length (cm)', data=df, kind='reg', color='green')
plt.suptitle('Joint Plot - Sepal vs Petal Length', y=1.02)
plt.show()
```

```
# j) Swarm Plot
plt.figure(figsize=(6,4))
sns.swarmplot(x='species', y='petal width (cm)', data=df, palette='Set2')
plt.title('Swarm Plot - Petal Width by Species')
plt.show()
```

```
# k) 3D Plot (Matplotlib)
from mpl_toolkits.mplot3d import Axes3D
fig = plt.figure(figsize=(7,5))
ax = fig.add_subplot(111, projection='3d')
for species in df['species'].unique():
    subset = df[df['species'] == species]
    ax.scatter(subset['sepal length (cm)'], subset['sepal width (cm)'], subset['petal length (cm)'], label=species)
ax.set_xlabel('Sepal Length')
ax.set_ylabel('Sepal Width')
ax.set_zlabel('Petal Length')
```

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plt.title('3D Scatter Plot')
plt.legend()
plt.show()
```

```
# l) Pairwise Correlation Cluster Map
sns.clustermap(df.drop(columns='species').corr(), annot=True, cmap='coolwarm')
plt.suptitle('Cluster Map - Correlation Matrix', y=1.02)
plt.show()
```

```
# m) Interactive Visualization (Plotly)
fig = px.scatter_3d(df, x='sepal length (cm)', y='sepal width (cm)', z='petal length (cm)',
                    color='species', title='Interactive 3D Scatter Plot')
fig.show()
```

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# ------------------------------------------------------------
# Step 6: Analysis and Conclusion
# ------------------------------------------------------------
print("\nAnalysis:")
```