```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import math
plt.rcParams.update({
    "font.size": 15,
    "font.family": "Arial"
})
bxwidth = 1
```

```
df = pd.read_csv("D:/pml/Iris.csv")
df
```

```
      Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  \
0      1            5.1           3.5            1.4           0.2   
1      2            4.9           3.0            1.4           0.2   
2      3            4.7           3.2            1.3           0.2   
3      4            4.6           3.1            1.5           0.2   
4      5            5.0           3.6            1.4           0.2   
..   ...            ...           ...            ...           ...   
145  146            6.7           3.0            5.2           2.3   
146  147            6.3           2.5            5.0           1.9   
147  148            6.5           3.0            5.2           2.0   
148  149            6.2           3.4            5.4           2.3   
149  150            5.9           3.0            5.1           1.8   

            Species  
0       Iris-setosa  
1       Iris-setosa  
2       Iris-setosa  
3       Iris-setosa  
4       Iris-setosa  
..              ...  
145  Iris-virginica  
146  Iris-virginica  
147  Iris-virginica  
148  Iris-virginica  
149  Iris-virginica  

[150 rows x 6 columns]
```

```
print(df.describe())
print(df.info())
```

```
               Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  
PetalWidthCm
count  150.000000     150.000000    150.000000     150.000000  
150.000000
mean    75.500000       5.843333      3.054000       3.758667  
```

```
1.198667
std     43.445368       0.828066      0.433594       1.764420
0.763161
min      1.000000       4.300000      2.000000       1.000000
0.100000
25%     38.250000       5.100000      2.800000       1.600000
0.300000
50%     75.500000       5.800000      3.000000       4.350000
1.300000
75%    112.750000       6.400000      3.300000       5.100000
1.800000
max    150.000000       7.900000      4.400000       6.900000
2.500000
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Id             150 non-null    int64
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
None
```

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

```
Id                0
SepalLengthCm     0
SepalWidthCm      0
PetalLengthCm     0
PetalWidthCm      0
Species           0
dtype: int64
```

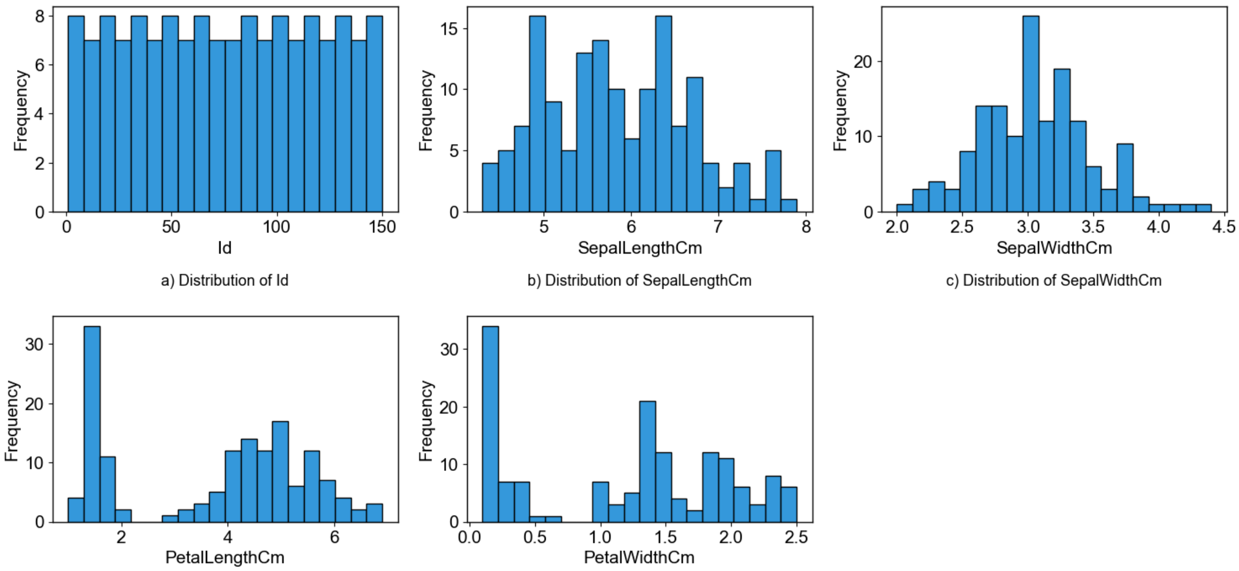
```
cols = df.columns
print(cols)
```

```
Index(['Id', 'SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm',
'PetalWidthCm',
       'Species'],
      dtype='object')
```

```
numeric_cols = df.select_dtypes(include=["int64", "float64"]).columns
print(numeric_cols)
```

```
Index(['Id', 'SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm',
'PetalWidthCm'], dtype='object')
```

```python
numeric_df = df.select_dtypes(include=["int64", "float64"])
cols = numeric_df.columns
rows = math.ceil(len(cols) / 3)

fig, axes = plt.subplots(rows, 3, figsize=(15, 4 * rows))
axes = axes.flatten()
subplot_labels = [f"{chr(97+i)})" for i in range(len(cols))]

for i, col in enumerate(cols):
    ax = axes[i]
    ax.hist(numeric_df[col].dropna(), bins=20, edgecolor="black", color="#3498db")

    ax.set_title("")
    ax.set_xlabel(col)
    ax.set_ylabel("Frequency")

    ax.text(
        0.5, -0.30,
        f"{subplot_labels[i]} Distribution of {col}",
        ha="center",
        va="top",
        transform=ax.transAxes,
        fontsize=13
    )

    for spine in ax.spines.values():
        spine.set_linewidth(bxwidth)

for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

fig.text(
    0.5, 0.01,
    "Histograms showing the distribution of physical measurements in the Iris dataset.",
    ha="center",
    fontsize=15
)

plt.tight_layout(rect=[0, 0.05, 1, 1])
plt.savefig("histogram_iris_features.eps", format="eps", dpi=600, bbox_inches="tight")
plt.show()
```



a) Distribution of Id

b) Distribution of SepalLengthCm

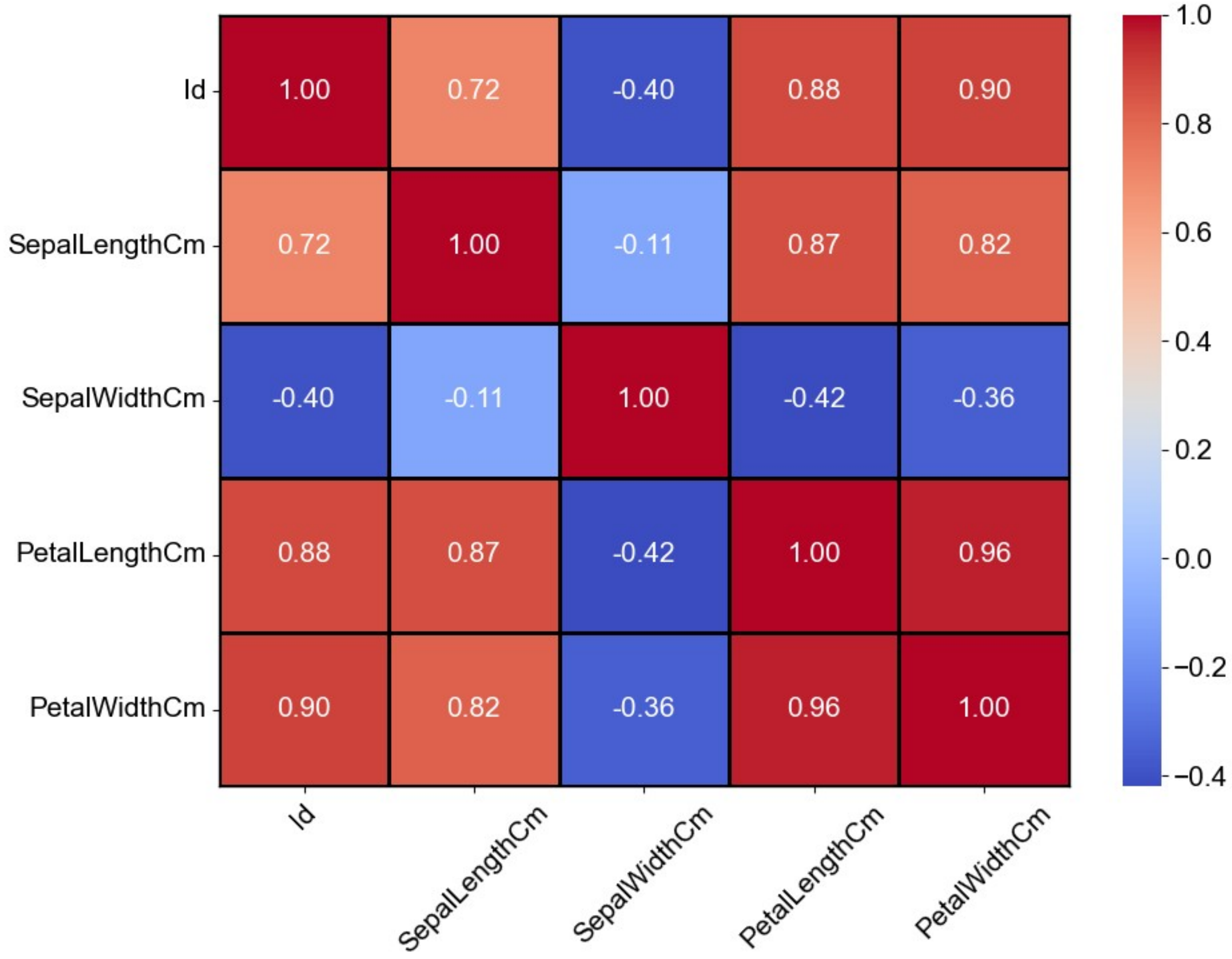
c) Distribution of SepalWidthCm

d) Distribution of PetalLengthCm

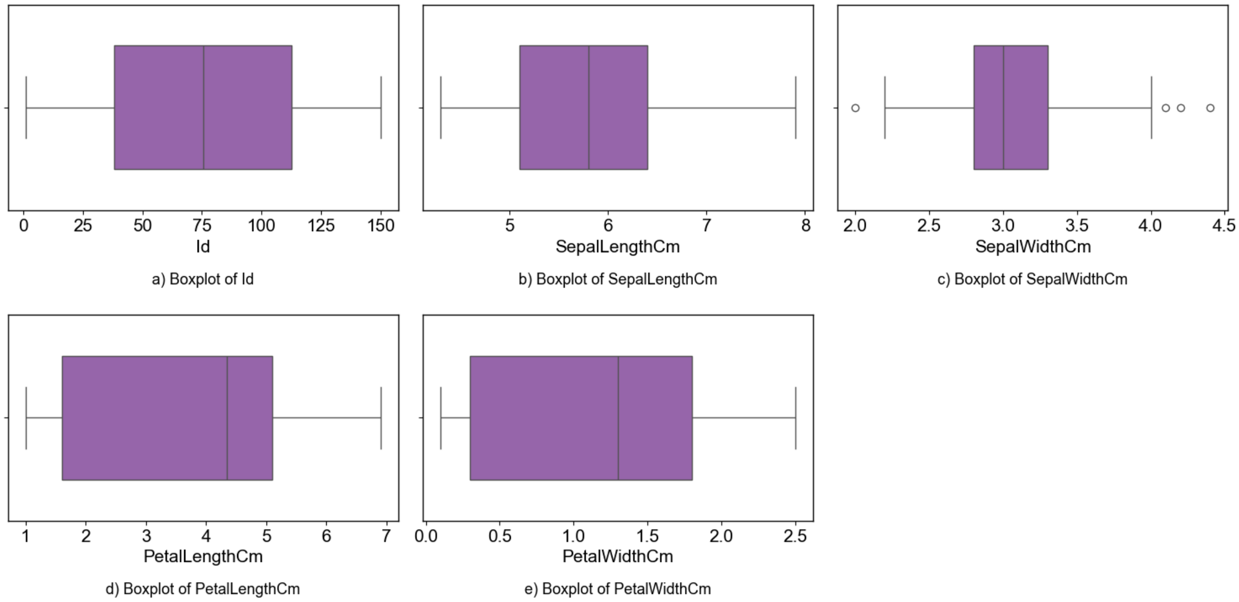
e) Distribution of PetalWidthCm

Histograms showing the distribution of physical measurements in the Iris dataset.

```
plt.figure(figsize=(10, 8))
corr_matrix = numeric_df.corr()

ax = sns.heatmap(corr_matrix, annot=True, cmap="coolwarm", fmt=".2f",
linewidths=1, linecolor='black')

for _, spine in ax.spines.items():
    spine.set_visible(True)
    spine.set_linewidth(bxwidth)

plt.title("")
plt.xticks(rotation=45)

fig.text(
    0.5, 0.01,
    "Correlation Heatmap of Iris numeric features.",
    ha="center", fontsize=15
)

plt.tight_layout(rect=[0, 0.05, 1, 1])
plt.savefig("correlation_iris_matrix.eps", format="eps", dpi=600,
bbox_inches="tight")
plt.show()
```



```
fig, axes = plt.subplots(rows, 3, figsize=(15, 4 * rows))
axes = axes.flatten()

for i, col in enumerate(cols):
    ax = axes[i]
    sns.boxplot(x=numeric_df[col], ax=ax, color="#9b59b6", width=0.6)

    ax.set_title("")
    ax.set_xlabel(col)

    ax.text(
        0.5, -0.30,
        f"{subplot_labels[i]} Boxplot of {col}",
        ha="center", va="top", transform=ax.transAxes, fontsize=13
    )

    for spine in ax.spines.values():
        spine.set_linewidth(bxwidth)

for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

fig.text(
    0.5, 0.01,
    "Boxplots identifying quartiles and outliers for Iris sepal and petal features.",
    ha="center", fontsize=15
)

plt.tight_layout(rect=[0, 0.05, 1, 1])
plt.savefig("boxplot_iris_features.eps", format="eps", dpi=600, bbox_inches="tight")
plt.show()
```



a) Boxplot of Id

b) Boxplot of SepalLengthCm

c) Boxplot of SepalWidthCm

d) Boxplot of PetalLengthCm

e) Boxplot of PetalWidthCm

Boxplots identifying quartiles and outliers for Iris sepal and petal features.