```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import classification_report, confusion_matrix
```

```
# Load the Iris dataset
df = pd.read_csv("Iris.csv")
df
```

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

150 rows × 6 columns

Next steps: Generate code with df New interactive sheet

```
# Drop the 'Id' column as it's not needed
df = df.drop('Id', axis=1)
df
```

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

150 rows × 5 columns

Next steps: Generate code with df New interactive sheet

```
# Explore the data
print("Dataset Info:")
print(df.info())
```

```
Dataset Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
```

```
Data columns (total 5 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   SepalLengthCm  150 non-null    float64
 1   SepalWidthCm   150 non-null    float64
 2   PetalLengthCm  150 non-null    float64
 3   PetalWidthCm   150 non-null    float64
 4   Species        150 non-null    object
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
None
```

```
print("\nFirst 5 rows:")
print(df.head())
```

```
First 5 rows:
   SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm      Species
0            5.1           3.5            1.4           0.2  Iris-setosa
1            4.9           3.0            1.4           0.2  Iris-setosa
2            4.7           3.2            1.3           0.2  Iris-setosa
3            4.6           3.1            1.5           0.2  Iris-setosa
4            5.0           3.6            1.4           0.2  Iris-setosa
```

```
print("\nSpecies distribution:")
print(df['Species'].value_counts())
```

```
Species distribution:
Species
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: count, dtype: int64
```

```
# Standardize the Variables
scaler = StandardScaler()
scaler.fit(df.drop('Species', axis=1))
scaled_features = scaler.transform(df.drop('Species', axis=1))
```

```
# Create a new DataFrame with the scaled features
df_feat = pd.DataFrame(scaled_features, columns=df.columns[:-1])
print("\nScaled features:")
print(df_feat.head())
```

```
Scaled features:
   SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm
0      -0.900681      1.032057      -1.341272     -1.312977
1      -1.143017     -0.124958      -1.341272     -1.312977
2      -1.385353      0.337848      -1.398138     -1.312977
3      -1.506521      0.106445      -1.284407     -1.312977
4      -1.021849      1.263460      -1.341272     -1.312977
```

```
# Train Test Split
X = df_feat
y = df['Species']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.30, random_state=42)
```

```
# Using KNN with k=1
knn = KNeighborsClassifier(n_neighbors=1)
knn.fit(X_train, y_train)
pred = knn.predict(X_test)
```

```
# Predictions and Evaluations
print("\nConfusion Matrix (k=1):")
print(confusion_matrix(y_test, pred))
print("\nClassification Report (k=1):")
print(classification_report(y_test, pred))
```

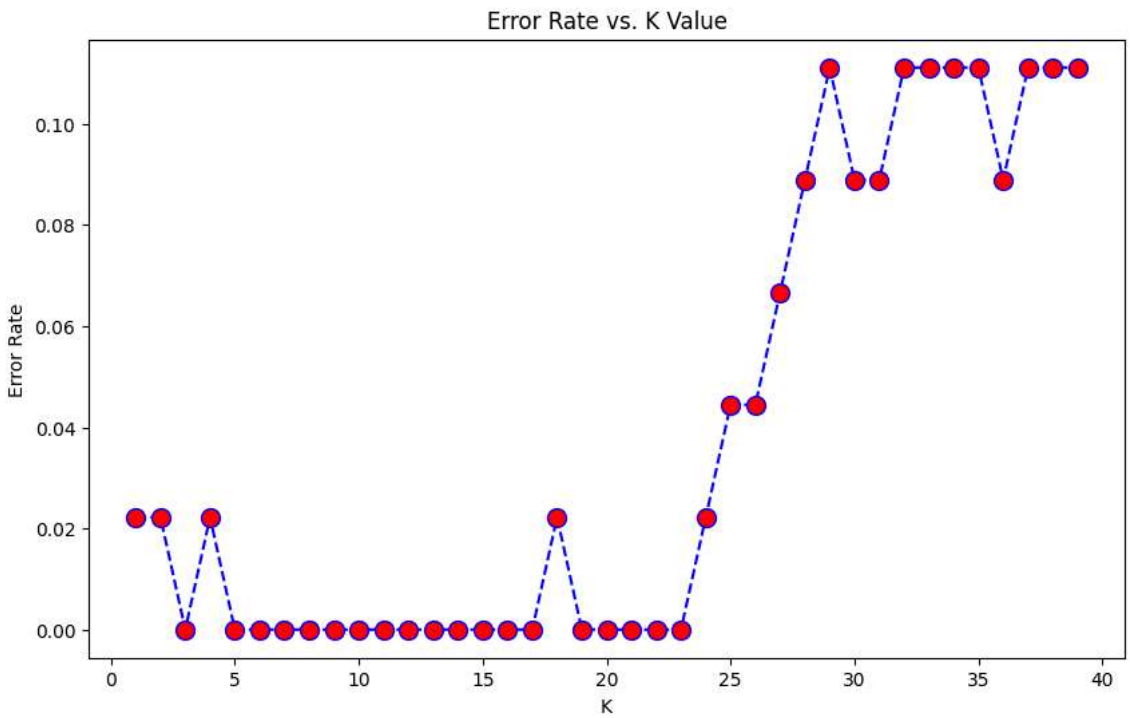
```
Confusion Matrix (k=1):
[[19  0  0]
 [ 0 12  1]
 [ 0  0 13]]
```

```
Classification Report (k=1):
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        19
Iris-versicolor       1.00      0.92      0.96        13
 Iris-virginica       0.93      1.00      0.96        13

       accuracy                           0.98        45
      macro avg       0.98      0.97      0.97        45
   weighted avg       0.98      0.98      0.98        45
```

```
# Choosing a K Value
error_rate = []
```

```
# Will take some time
for i in range(1, 40):
    knn = KNeighborsClassifier(n_neighbors=i)
    knn.fit(X_train, y_train)
    pred_i = knn.predict(X_test)
    error_rate.append(np.mean(pred_i != y_test))
```

```
# Plot the error rate
plt.figure(figsize=(10, 6))
plt.plot(range(1, 40), error_rate, color='blue', linestyle='dashed', marker='o',
         markerfacecolor='red', markersize=10)
plt.title('Error Rate vs. K Value')
plt.xlabel('K')
plt.ylabel('Error Rate')
plt.show()
```




```
# Find the optimal K value
optimal_k = error_rate.index(min(error_rate)) + 1
print(f"\nOptimal K value: {optimal_k}")
```

```
Optimal K value: 3
```

```
# Retrain with optimal K
knn_optimal = KNeighborsClassifier(n_neighbors=optimal_k)
knn_optimal.fit(X_train, y_train)
pred_optimal = knn_optimal.predict(X_test)
```

```
print(f"\nConfusion Matrix (k={optimal_k}):")
print(confusion_matrix(y_test, pred_optimal))
print(f"\nClassification Report (k={optimal_k}):")
print(classification_report(y_test, pred_optimal))
```

```
Confusion Matrix (k=3):
[[19  0  0]
 [ 0 13  0]
 [ 0  0 13]]

Classification Report (k=3):
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        19
Iris-versicolor       1.00      1.00      1.00        13
 Iris-virginica       1.00      1.00      1.00        13

       accuracy                           1.00        45
      macro avg       1.00      1.00      1.00        45
   weighted avg       1.00      1.00      1.00        45
```

```
# Compare with k=1
print("\nComparison between k=1 and optimal k:")
print("WITH K=1")
print(confusion_matrix(y_test, pred))
print(classification_report(y_test, pred))
```

```
Comparison between k=1 and optimal k:
WITH K=1
[[19  0  0]
 [ 0 12  1]
 [ 0  0 13]]
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        19
Iris-versicolor       1.00      0.92      0.96        13
 Iris-virginica       0.93      1.00      0.96        13

       accuracy                           0.98        45
      macro avg       0.98      0.97      0.97        45
   weighted avg       0.98      0.98      0.98        45
```

```
print(f"\nWITH K={optimal_k}")
print(confusion_matrix(y_test, pred_optimal))
print(classification_report(y_test, pred_optimal))
```

```
WITH K=3
[[19  0  0]
 [ 0 13  0]
 [ 0  0 13]]
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        19
Iris-versicolor       1.00      1.00      1.00        13
 Iris-virginica       1.00      1.00      1.00        13

       accuracy                           1.00        45
      macro avg       1.00      1.00      1.00        45
   weighted avg       1.00      1.00      1.00        45
```

Start coding or generate with AI.