Iris Flower Classification

Importing Libraries

In [10]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns

## Supress warnings
import warnings
warnings.filterwarnings("ignore")
```

In [11]:
```
iris_df = pd.read_csv("iris.csv")
print("the data has been successfully load.")
```

```
the data has been successfully load.
```

In [12]:
```
iris_df
```

Out[12]:

	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

Data Exploration

In [13]:
```
#check shape of data
iris_df.shape
```

Out[13]:
```
(150, 6)
```

In [14]:
```
# check basic informationof data
iris_df.info()
```

```
<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
```

In [15]:
```
# check statistical summary of data
iris_df.describe()
```

Out[15]:

	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

In [16]:
```
#Check null values
iris_df.isnull().sum()
```

Out[16]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

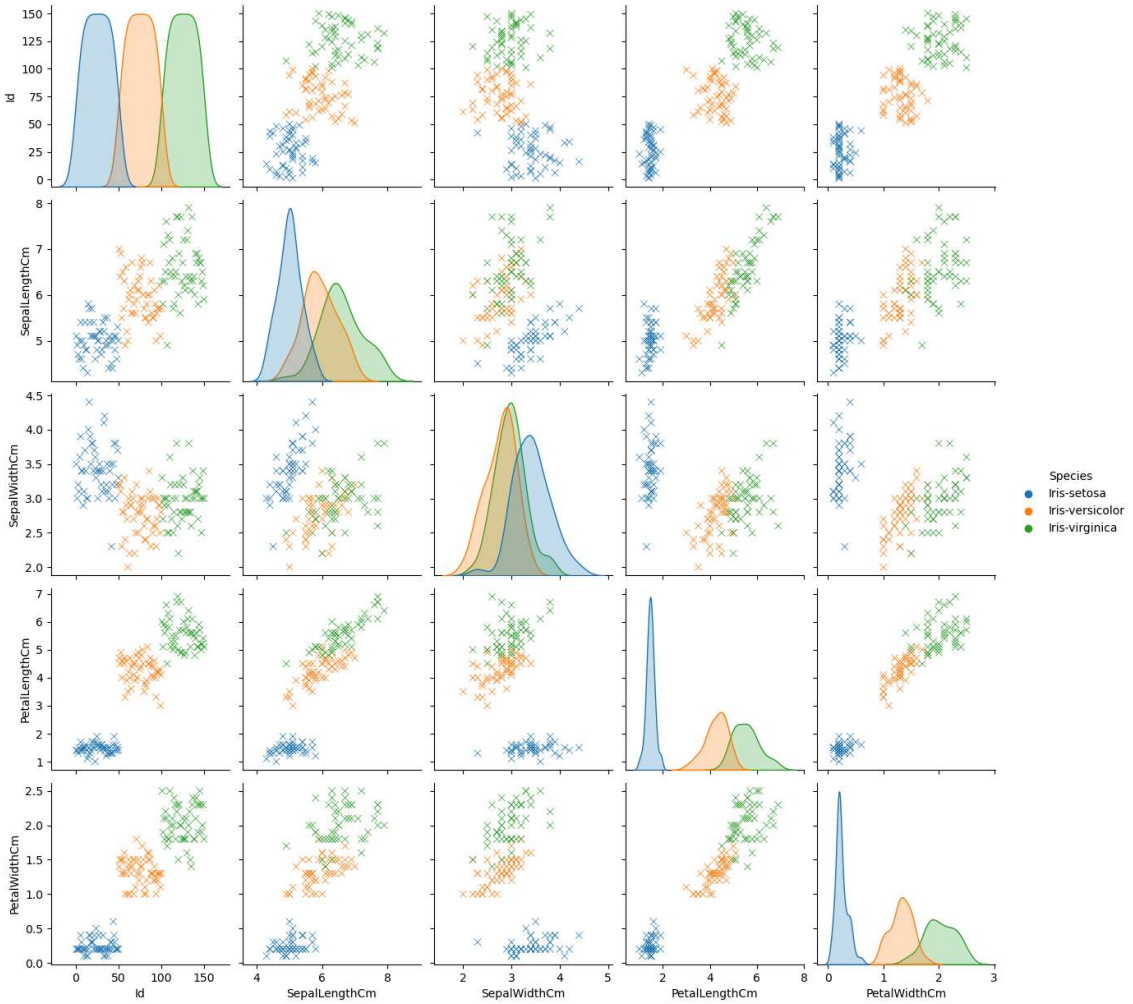
In [18]:
```
print("unique number of values in dataset Species:",iris_df["Species"].nuni
print("Unique Species in iris dataset:",iris_df["Species"].unique())
```

```
unique number of values in dataset Species: 3
Unique Species in iris dataset: ['Iris-setosa' 'Iris-versicolor' 'Iris-vi
rginica']
```

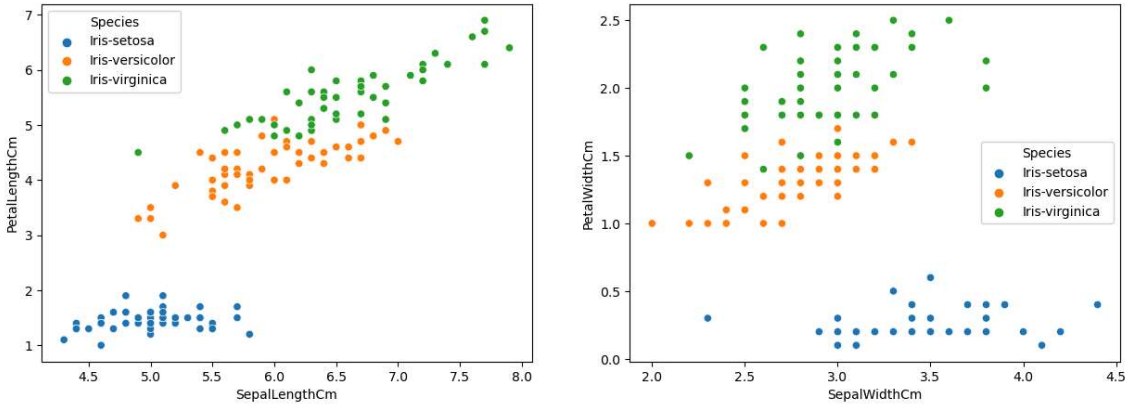
Exploratory Data Analysis

Data Visualization

In [19]:
```
sns.pairplot(iris_df, hue = "Species",markers = "x")
plt.show()
```



In [20]:
```
plt.figure(figsize=(15,5))
plt.subplot(1,2,1)
sns.scatterplot(x='SepalLengthCm',y='PetalLengthCm',data=iris_df,hue='Speci
plt.subplot(1,2,2)
sns.scatterplot(x='SepalWidthCm',y='PetalWidthCm',data=iris_df,hue='Species
plt.show()
```



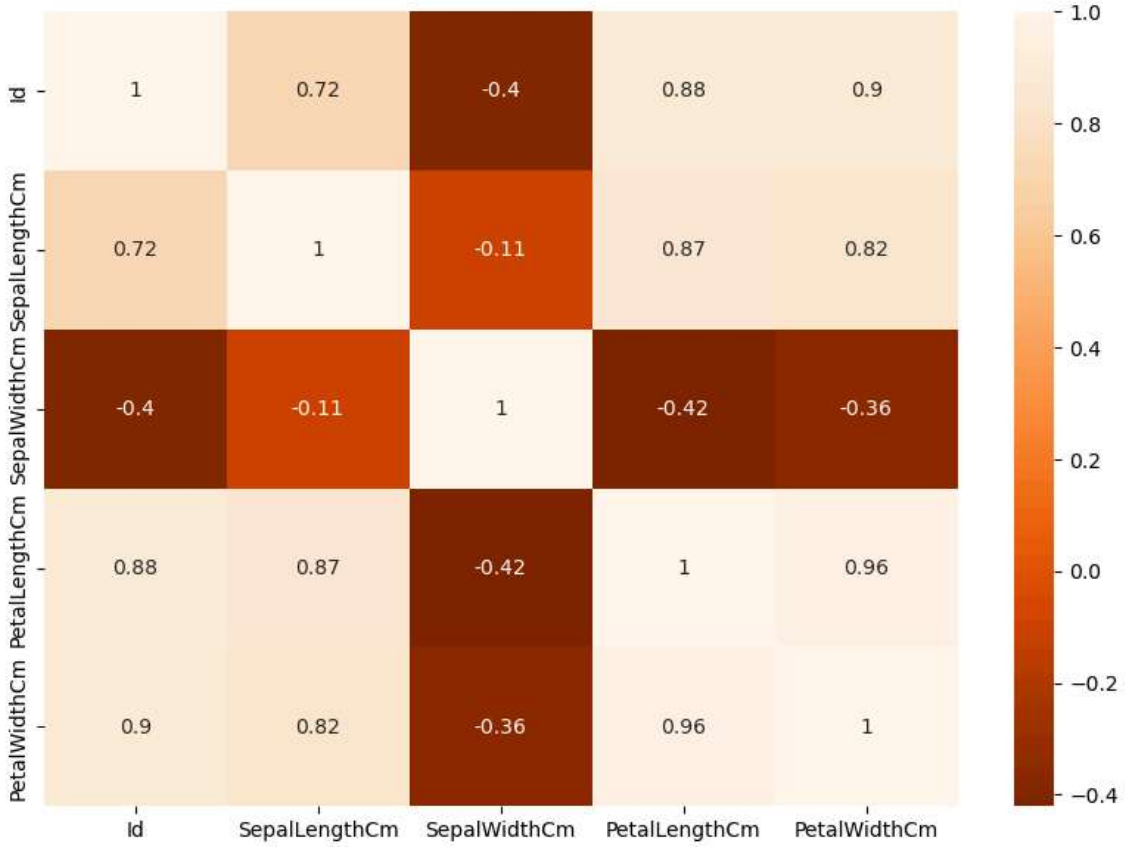
In [25]:

```
# Select only the numeric columns from the DataFrame
numeric_columns = iris_df.select_dtypes(include=[float, int])

# Calculate the correlation matrix
correlation_matrix = numeric_columns.corr()

# Display the correlation matrix
print(correlation_matrix)
```

```
                    Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  \
Id            1.000000       0.716676     -0.397729       0.882747
SepalLengthCm 0.716676       1.000000     -0.109369       0.871754
SepalWidthCm -0.397729      -0.109369      1.000000      -0.420516
PetalLengthCm 0.882747       0.871754     -0.420516       1.000000
PetalWidthCm  0.899759       0.817954     -0.356544       0.962757

               PetalWidthCm
Id                 0.899759
SepalLengthCm      0.817954
SepalWidthCm      -0.356544
PetalLengthCm      0.962757
PetalWidthCm       1.000000
```

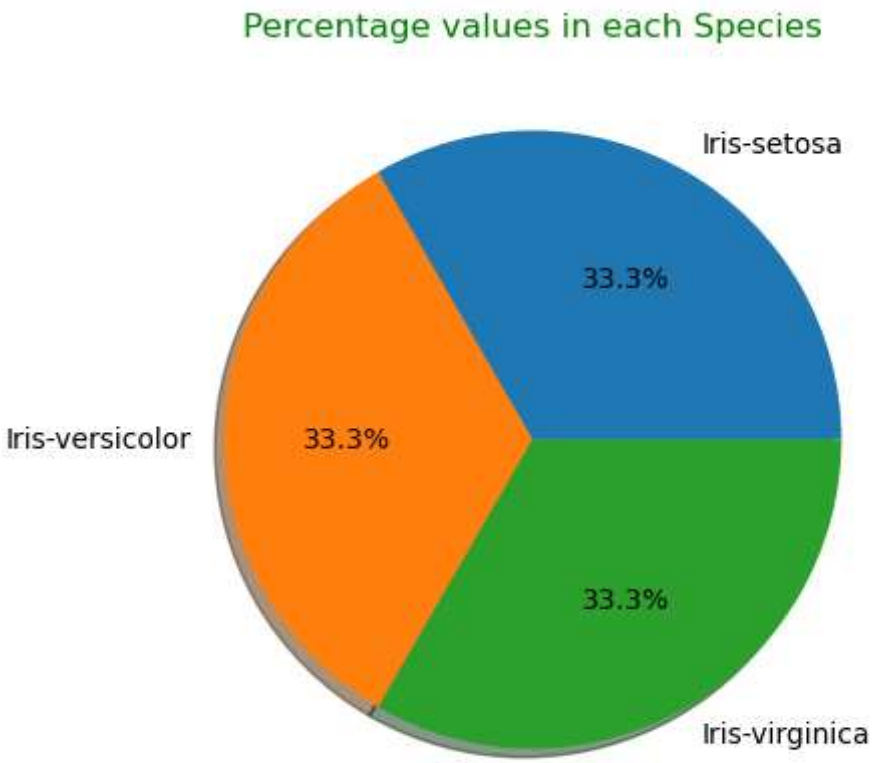
In [27]:

```
# Select only the numeric columns from the DataFrame
numeric_columns = iris_df.select_dtypes(include=[float, int])

# Calculate the correlation matrix for the numeric columns
correlation_matrix = numeric_columns.corr()

# Use a heatmap to visualize the correlation matrix
plt.figure(figsize=(10, 7))
sns.heatmap(correlation_matrix, annot=True, cmap="Oranges_r")
plt.show()
```



In [28]:

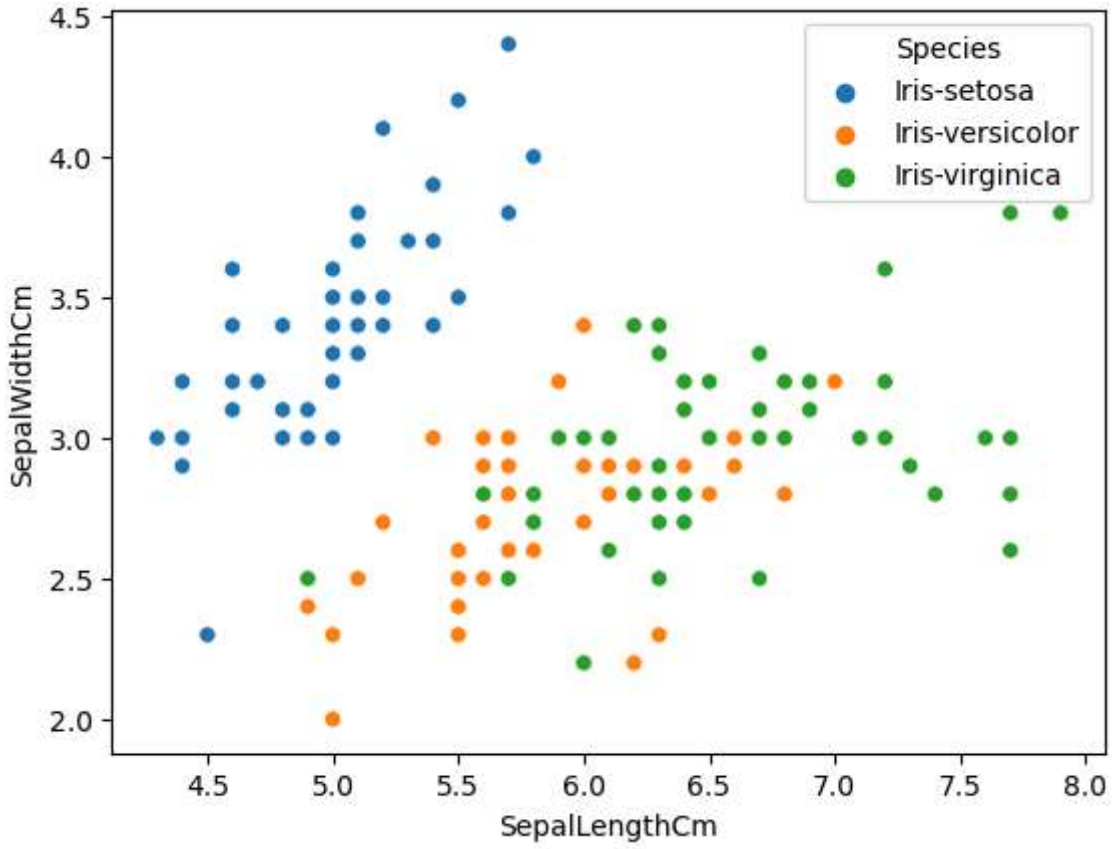
```
 # Check value counts
iris_df["Species"].value_counts().plot(kind="pie",autopct = "%1.1f%%",shadc
plt.title("Percentage values in each Species", fontsize = 12 , c = "g")
plt.ylabel("",fontsize=10,c="r")
plt.show()
```



Scatterplot for Sepal Length and Sepal Width

In [31]:

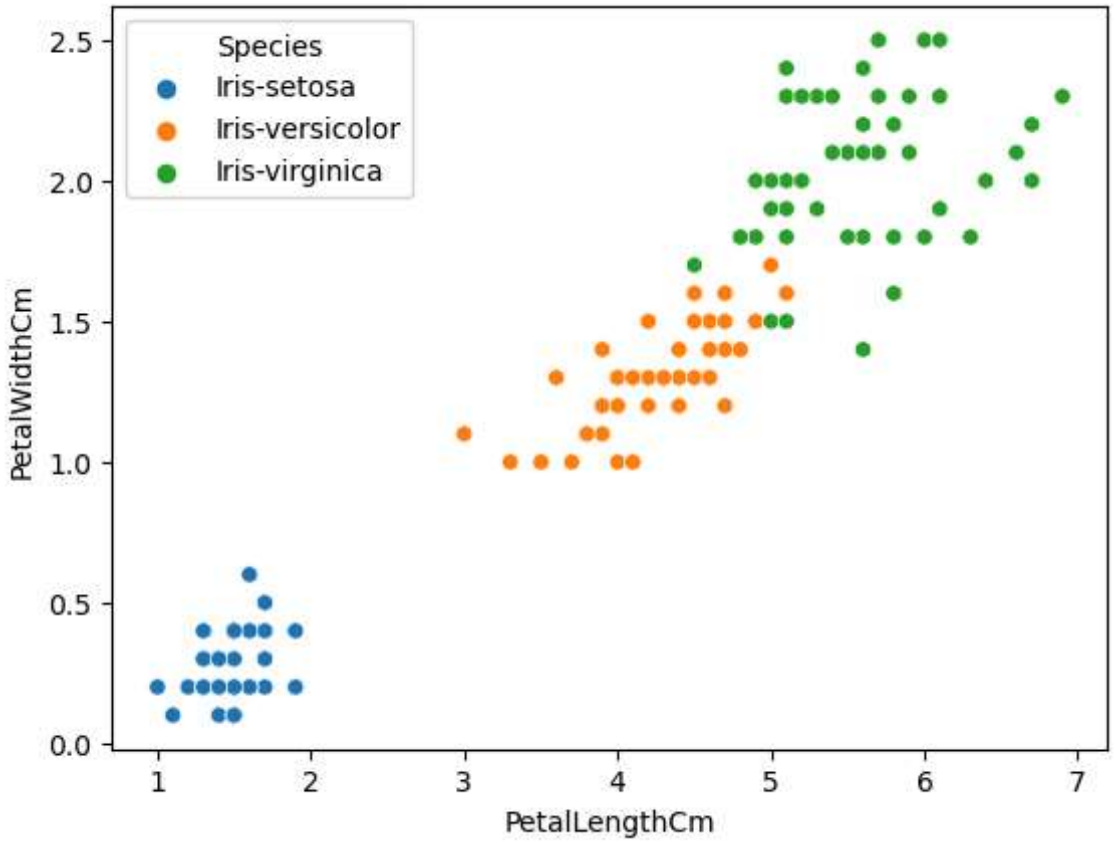
```
# Create a scatter plot with SepalLengthCm on the x-axis and SepalWidthCm c
sns.scatterplot(x=iris_df["SepalLengthCm"], y=iris_df["SepalWidthCm"], hue=

# Show the plot
plt.show()
```



Scatterplot for Petal Length and Petal Width

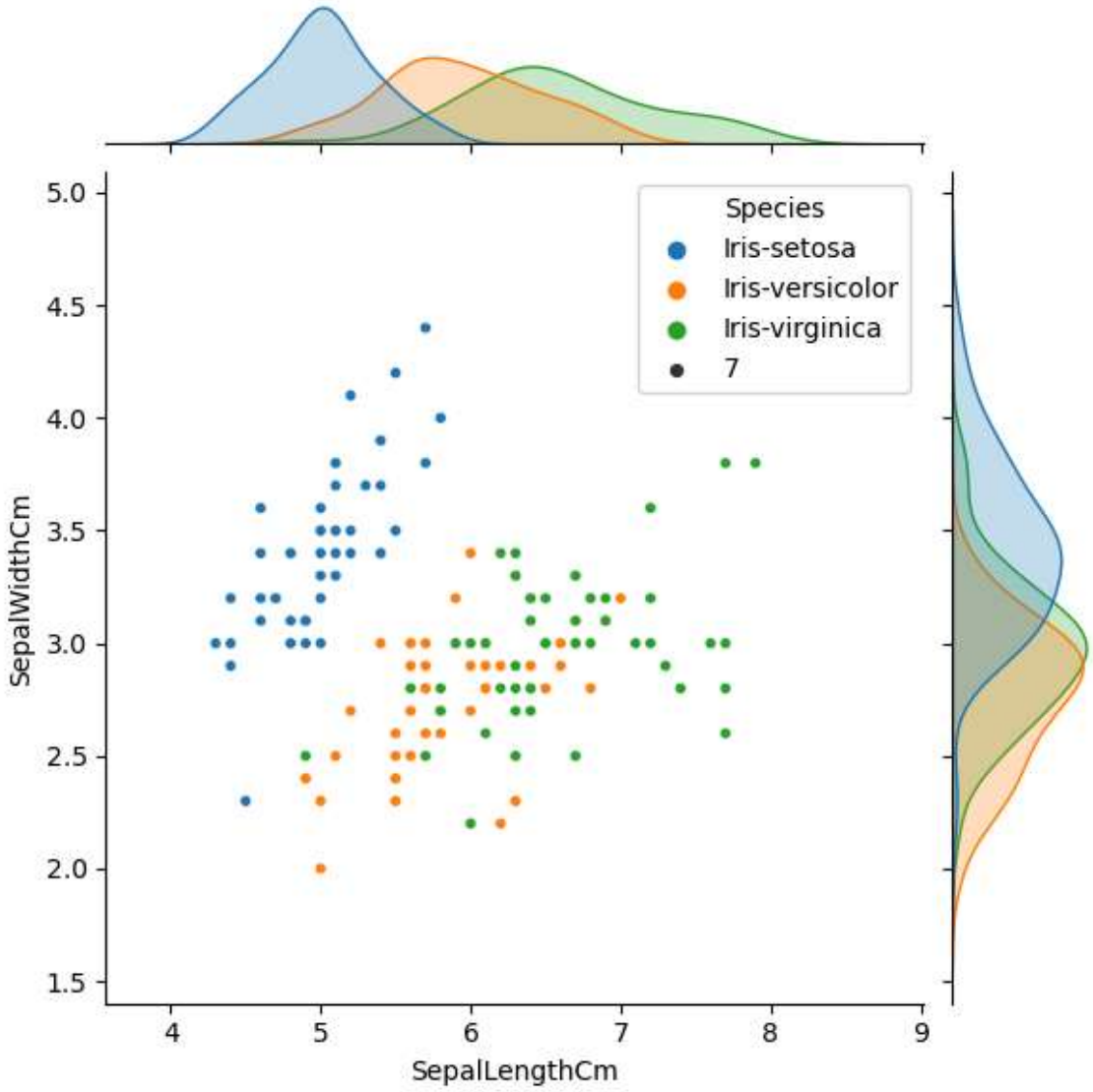
In [32]:

```
# Create a scatter plot with PetalLengthCm on the x-axis and PetalWidthCm c
sns.scatterplot(x=iris_df["PetalLengthCm"], y=iris_df["PetalWidthCm"], hue=

# Show the plot
plt.show()
```



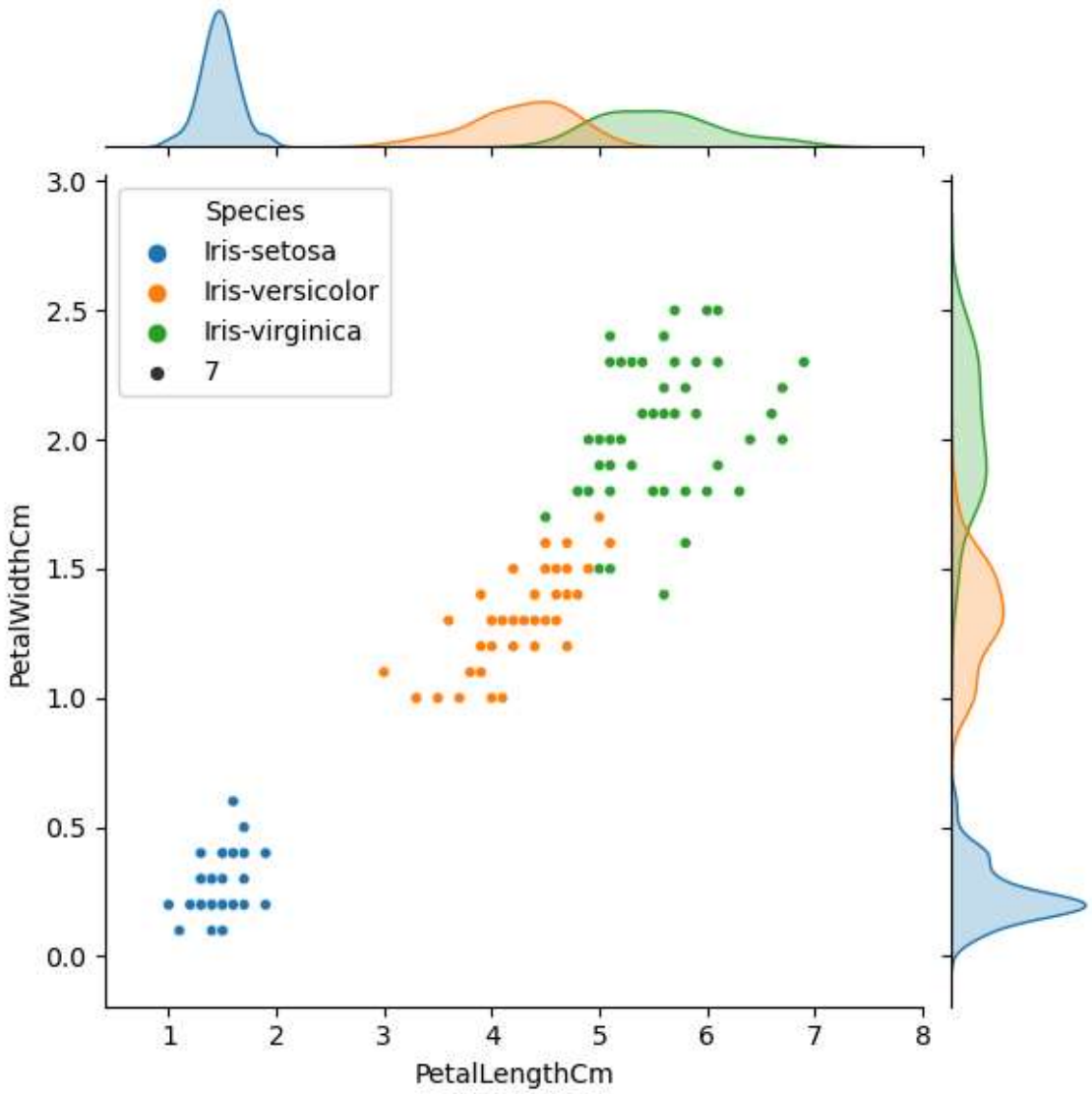
In [33]:

```
sns.jointplot(data = iris_df , x = "SepalLengthCm", y = "SepalWidthCm" , si
plt.show()
```



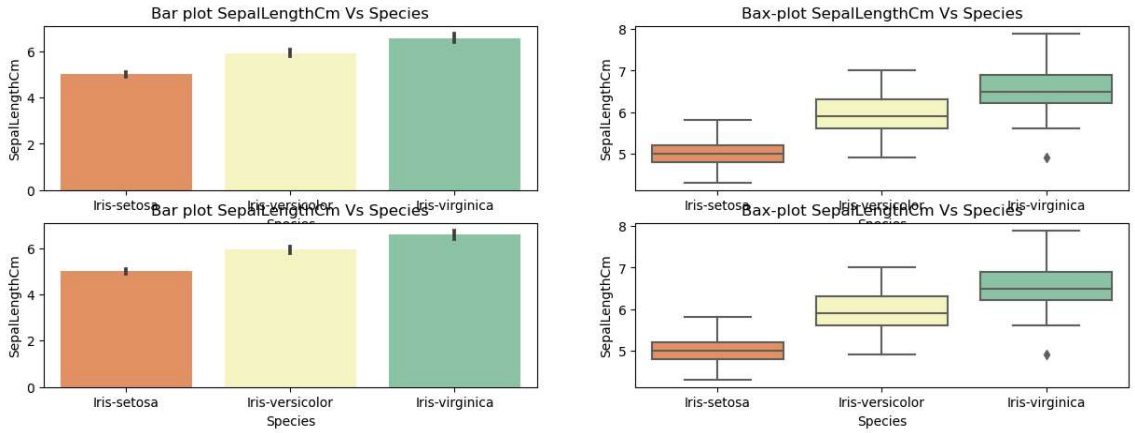
In [34]:

```
sns.jointplot(data = iris_df , x = "PetalLengthCm", y = "PetalWidthCm" , si
plt.show()
```



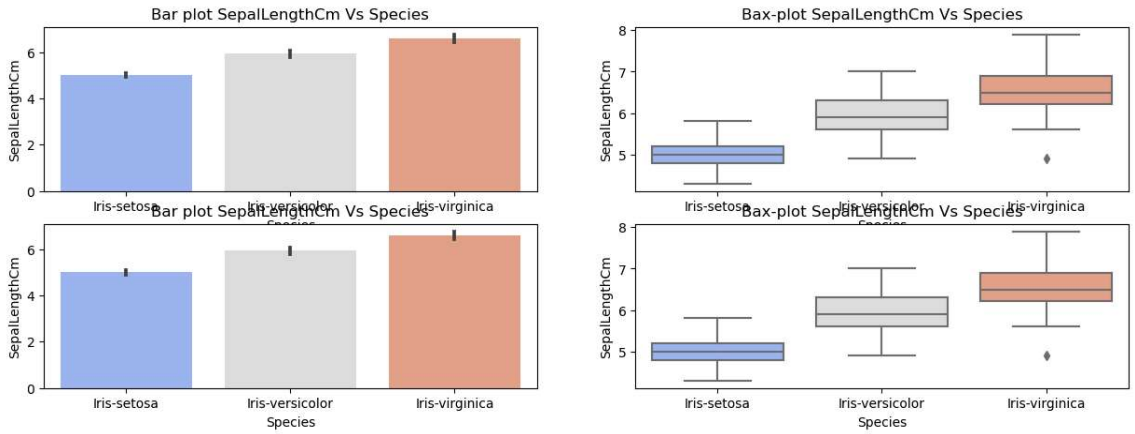
In [35]:

```
plt.figure(figsize = (15,5))
plt.subplot(2,2,1)
sns.barplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("Spec
plt.title("Bar plot SepalLengthCm Vs Species")

plt.subplot(2,2,2)
sns.boxplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("Spec
plt.title("Bax-plot SepalLengthCm Vs Species")

plt.subplot(2,2,3)
sns.barplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("Spec
plt.title("Bar plot SepalLengthCm Vs Species")

plt.subplot(2,2,4)
sns.boxplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("Spec
plt.title("Bax-plot SepalLengthCm Vs Species")

plt.show()
```



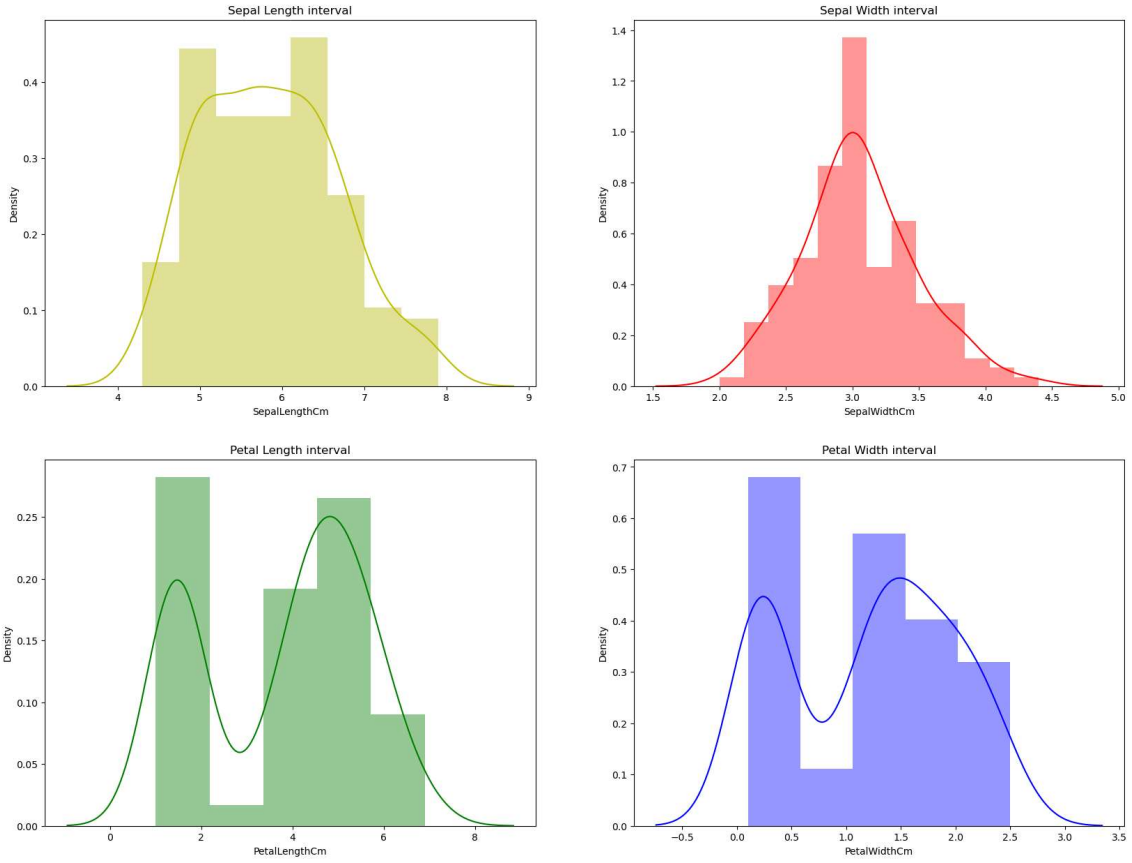
In [37]:

```
plt.figure(figsize = (15,5))
plt.subplot(2,2,1)
sns.barplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("cool
plt.title("Bar plot SepalLengthCm Vs Species")

plt.subplot(2,2,2)
sns.boxplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("cool
plt.title("Bax-plot SepalLengthCm Vs Species")


plt.subplot(2,2,3)
sns.barplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("cool
plt.title("Bar plot SepalLengthCm Vs Species")

plt.subplot(2,2,4)
sns.boxplot(x = "Species",y = "SepalLengthCm", data=iris_df, palette=("cool
plt.title("Bax-plot SepalLengthCm Vs Species")

plt.show()
```



In [38]:

```
plt.figure(figsize=(20,15))
plt.subplot(2,2,1)
sns.distplot(iris_df["SepalLengthCm"],color="y").set_title("Sepal Length ir

plt.subplot(2,2,2)
sns.distplot(iris_df["SepalWidthCm"],color="r").set_title("Sepal Width inte

plt.subplot(2,2,3)
sns.distplot(iris_df["PetalLengthCm"],color="g").set_title("Petal Length ir

plt.subplot(2,2,4)
sns.distplot(iris_df["PetalWidthCm"],color="b").set_title("Petal Width inte

plt.show()
```



Data Cleaning

In [40]:
```
# Change Categorical Data into numerical value
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
iris_df["Species"] = le.fit_transform(iris_df["Species"])
iris_df.head()
```

Out[40]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	0
1	2	4.9	3.0	1.4	0.2	0
2	3	4.7	3.2	1.3	0.2	0
3	4	4.6	3.1	1.5	0.2	0
4	5	5.0	3.6	1.4	0.2	0

In [41]:
```
iris_df['Species'].unique()
```

Out[41]:
```
array([0, 1, 2])
```

In [42]:
```
X = iris_df.iloc[:,[0,1,2,3]]
X.head()
```

Out[42]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm
0	1	5.1	3.5	1.4
1	2	4.9	3.0	1.4
2	3	4.7	3.2	1.3
3	4	4.6	3.1	1.5
4	5	5.0	3.6	1.4

In [43]:
```
y = iris_df.iloc[:, - 1]
y.head()
```

Out[43]:
```
0    0
1    0
2    0
3    0
4    0
Name: Species, dtype: int32
```

In [44]:
```
print(X.shape)
print(y.shape)
```

```
(150, 4)
(150,)
```

Model Building

```
Split data into Training and Testing Set
```

In [45]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,randc
```

In [46]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(120, 4)
(30, 4)
(120,)
(30,)
```

Logistic Regression

In [47]:
```
from sklearn.linear_model import LogisticRegression
lr= LogisticRegression()
lr.fit(X_train, y_train)
print("Logistic regression successfully implemented")
y_pred = lr.predict(X_test)
#Confusion Matrix
from sklearn.metrics import confusion_matrix, accuracy_score, classificatic
cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:-")
print(cm)
accuracy = accuracy_score(y_test, y_pred)
print("accuracy is:-",accuracy*100)
print("Classification Report:-")
print(classification_report(y_test,y_pred))
```

```
Logistic regression successfully implemented
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
accuracy is:- 100.0
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00         6

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

Random Forest Classifier

In [48]:

```
from sklearn.ensemble import RandomForestClassifier
rfc = RandomForestClassifier()

rfc.fit(X_train, y_train)
print("Rndom Forest Classifier successfully Implimented")

y_pred = rfc.predict(X_test)

#confusion matrix
cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:- ")
print(cm)

#accuracy test
accuracy = accuracy_score(y_test,y_pred)

print("accuracy:- ", accuracy*100)

print("Classification Report:-")
print( classification_report(y_test, y_pred))
```

```
Rndom Forest Classifier successfully Implimented
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
accuracy:-  100.0
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00         6

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

Decision Tree

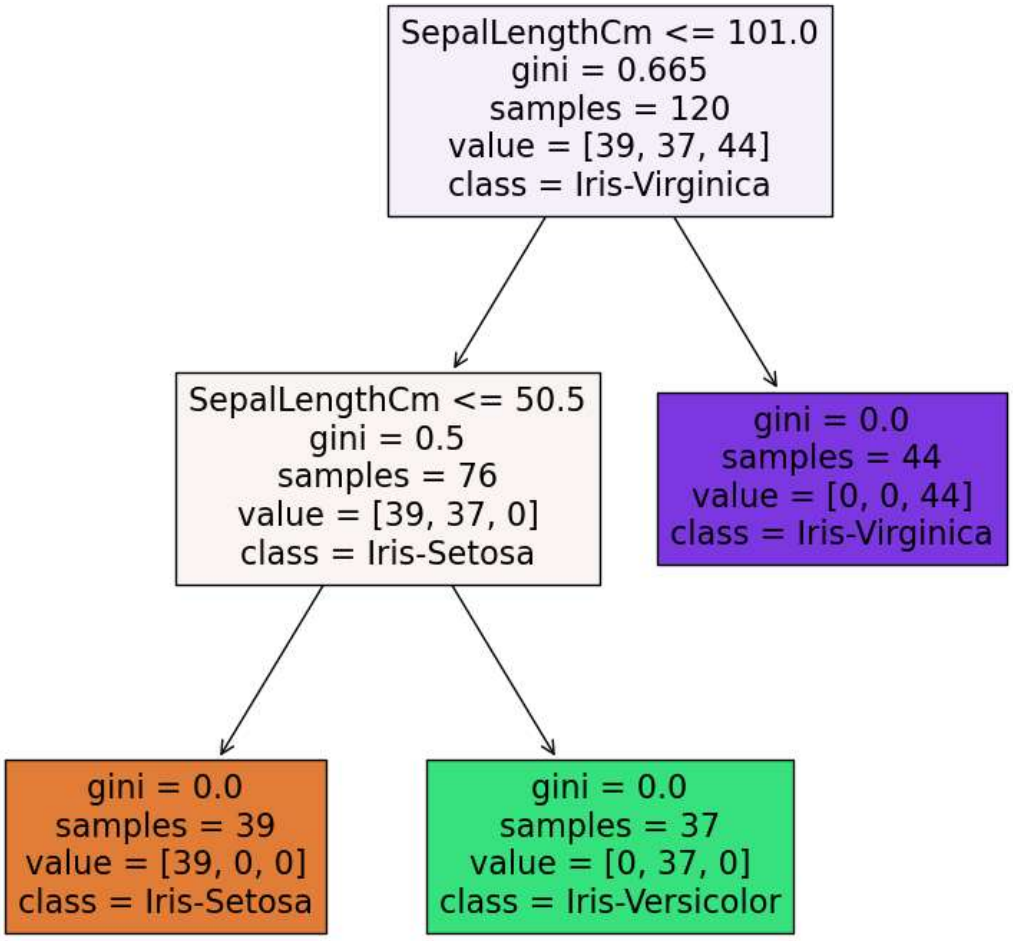
In [49]:
```
from sklearn.tree import DecisionTreeClassifier

dtree = DecisionTreeClassifier()

dtree.fit(X_train, y_train)
print("Decision Tree Algorithm is successfully implimented.")

y_pred = dtree.predict(X_test)

#confusion matrix
cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:- ")
print(cm)

#accuracy test
accuracy = accuracy_score(y_test,y_pred)
print("accuracy:- ", accuracy*100)

print("Classification Report:-")
print( classification_report(y_test, y_pred))
```

```
Decision Tree Algorithm is successfully implimented.
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  1  5]]
accuracy:-  96.66666666666667
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       0.93      1.00      0.96        13
           2       1.00      0.83      0.91         6

    accuracy                           0.97        30
   macro avg       0.98      0.94      0.96        30
weighted avg       0.97      0.97      0.97        30
```

In [50]:
```
from sklearn.tree import plot_tree
```

In [51]:
```
# for visualziing the Decision Tree
feature = ['SepalLengthCm','SepalWidthCm','PetalLengthCm','PetalWidthCm']
classes = ['Iris-Setosa','Iris-Versicolor','Iris-Virginica']
```

In [52]:
```
plt.figure(figsize=(10,10))
plot_tree(dtree, feature_names = feature, class_names = classes, filled = T
```



Support Vector Machine

In [53]:

```
from sklearn.svm import SVC
svc= SVC()

svc.fit(X_train, y_train)
print("Support vactor classifier is successfully implemented")

y_pred = svc.predict(X_test)

#confusion matrix
cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:- ")
print(cm)

#accuracy test
accuracy = accuracy_score(y_test,y_pred)
print("accuracy:- ", accuracy*100)

print("Classification Report:-")

print( classification_report(y_test, y_pred))
```

```
Support vactor classifier is successfully implemented
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
accuracy:-  100.0
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00         6

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

K - NN Classifier

In [54]:

```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors= 7)
knn.fit(X_train, y_train)

print("K-Nearest Neighbors classifier is successfully implemented")

y_pred = knn.predict(X_test)

#confusion matrix
cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:- ")
print(cm)

#accuracy test
accuracy = accuracy_score(y_test,y_pred)

print("accuracy:- ", accuracy*100)

print("Classification Report:-")
print( classification_report(y_test, y_pred))
```

```
K-Nearest Neighbors classifier is successfully implemented
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
accuracy:-  100.0
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00         6

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

Naive Bayes

In [55]:

```
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(X_train, y_train)
print("Naive Bayes is successfully implemented")

y_pred = gnb.predict(X_test)

cm = confusion_matrix(y_pred, y_test)
print("Confusion Matrix:- ")
print(cm)

# Accuracy test
accuracy = accuracy_score(y_test, y_pred)
print("accuracy:- ", accuracy*100)

print("Classification Report:-")
print( classification_report(y_test, y_pred))
```

```
Naive Bayes is successfully implemented
Confusion Matrix:-
[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
accuracy:-  100.0
Classification Report:-
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        11
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00         6

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

Result

1. Accuracy of Logistic Regression :- 100%
2. Accuracy of Random Forest Classifier:-100%
3. Accuracy of Decision Tree :- 96.66%
4. Accuracy of Support Vector Machine :- 100%
5. Accuracy of K-NN Classifier :- 100%
6. Accuracy of Naive Bayes :- 100%

Test Model

In [58]:

```
input_data=(4.9,3.0,1.4,0.2)

#changing the input data to a numpy array
input_data_as_nparray = np.asarray(input_data)

#reshape the data as we are predicting the label for only the instance
input_data_reshaped = input_data_as_nparray.reshape(1,-1)

prediction = dtree.predict(input_data_reshaped)
print("The category is",prediction)
```

```
The category is [0]
```