In [9]:

```python
 #for manipulation
import numpy as np
import pandas as pd

#for data visualization
import matplotlib.pyplot as plt
import seaborn as sns

#for implement ML
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score

#for interacitivity
from ipywidgets import interact
```

In [10]:

```python
data = pd.read_csv('IrisDATA.csv')
```

In [13]:

```python
print("Shape of data is: ", data.shape)
```

```
Shape of data is:  (150, 5)
```

In [14]:

```python
data.head()
```

Out[14]:

	sepal_length	sepal_width	petal_length	petal_width	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

In [15]:

```python
data.isnull().sum()
```

Out[15]:

```
sepal_length    0
sepal_width     0
petal_length    0
petal_width     0
species         0
dtype: int64
```

In [21]:

```python
data.value_counts()
```

Out[21]:

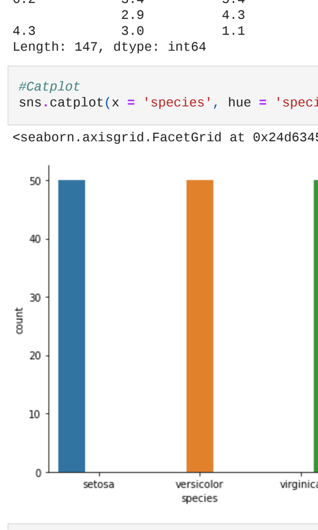
```
sepal_length  sepal_width  petal_length  petal_width  species
4.9           3.1          1.5           0.1          setosa        3
5.8           2.7          5.1           1.9          virginica     2
5.4           3.4          1.7           0.2          setosa        1
5.5           2.5          4.0           1.3          versicolor    1
              2.4          3.8           1.1          versicolor    1
                                                                   ..
6.3           2.5          4.9           1.5          versicolor    1
              2.3          4.4           1.3          versicolor    1
6.2           3.4          5.4           2.3          virginica     1
              2.9          4.3           1.3          versicolor    1
4.3           3.0          1.1           0.1          setosa        1
Length: 147, dtype: int64
```

In [24]:

```python
#Catplot
sns.catplot(x = 'species', hue = 'species', kind = 'count', data = data)
```

Out[24]:

```
<seaborn.axisgrid.FacetGrid at 0x24d634535f8>
```



In [26]:

```python
#Paired Plot
sns.set()
sns.pairplot(data[['sepal_length','sepal_width','petal_length','petal_width','species']], hue = "species", diag_ki
```

Out[26]:

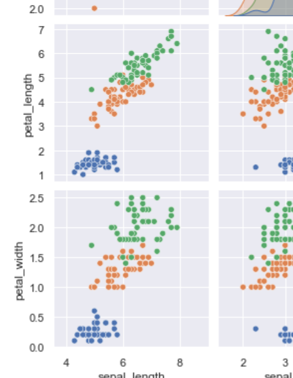
```
<seaborn.axisgrid.PairGrid at 0x24d65638ba8>
```

In [30]:

```python
#Bar plot for Species Vs Petal Width
plt.bar(data['species'],data['petal_width'])
```

Out[30]:

```
<BarContainer object of 150 artists>
```



In [31]:

```python
#Data Processing
data.describe()
```

Out[31]:

	sepal_length	sepal_width	petal_length	petal_width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

In [32]:

```python
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   sepal_length  150 non-null    float64
 1   sepal_width   150 non-null    float64
 2   petal_length  150 non-null    float64
 3   petal_width   150 non-null    float64
 4   species       150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

In [33]:

```python
data
```

Out[33]:

	sepal_length	sepal_width	petal_length	petal_width	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
...	...	...	...	...	...
145	6.7	3.0	5.2	2.3	virginica
146	6.3	2.5	5.0	1.9	virginica
147	6.5	3.0	5.2	2.0	virginica
148	6.2	3.4	5.4	2.3	virginica
149	5.9	3.0	5.1	1.8	virginica

150 rows × 5 columns

In [41]:

```python
Label_Encode = LabelEncoder()
Y = data['species']
Y = Label_Encode.fit_transform(Y)
```

In [42]:

```python
Y
```

Out[42]:

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2])
```

In [44]:

```python
data['species'].nunique()
```

Out[44]:

```
3
```

In [45]:

```python
X = np.array(X)
```

In [46]:

```python
X
```

Out[46]:

```
array([[5.1, 3.5, 1.4, 0.2],
       [4.9, 3. , 1.4, 0.2],
       [4.7, 3.2, 1.3, 0.2],
       [4.6, 3.1, 1.5, 0.2],
       [5. , 3.6, 1.4, 0.2],
       [5.4, 3.9, 1.7, 0.4],
       [4.6, 3.4, 1.4, 0.3],
       [5. , 3.4, 1.5, 0.2],
       [4.4, 2.9, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5.4, 3.7, 1.5, 0.2],
       [4.8, 3.4, 1.6, 0.2],
       [4.8, 3. , 1.4, 0.1],
       [4.3, 3. , 1.1, 0.1],
       [5.8, 4. , 1.2, 0.2],
       [5.7, 4.4, 1.5, 0.4],
       [5.4, 3.9, 1.3, 0.4],
       [5.1, 3.5, 1.4, 0.3],
       [5.7, 3.8, 1.7, 0.3],
       [5.1, 3.8, 1.5, 0.3],
       [5.4, 3.4, 1.7, 0.2],
       [5.1, 3.7, 1.5, 0.4],
       [4.6, 3.6, 1. , 0.2],
       [5.1, 3.3, 1.7, 0.5],
       [4.8, 3.4, 1.9, 0.2],
       [5. , 3. , 1.6, 0.2],
       [5. , 3.4, 1.6, 0.4],
       [5.2, 3.5, 1.5, 0.2],
       [5.2, 3.4, 1.4, 0.2],
       [4.7, 3.2, 1.6, 0.2],
       [4.8, 3.1, 1.6, 0.2],
       [5.4, 3.4, 1.5, 0.4],
       [5.2, 4.1, 1.5, 0.1],
       [5.5, 4.2, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5. , 3.2, 1.2, 0.2],
       [5.5, 3.5, 1.3, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [4.4, 3. , 1.3, 0.2],
       [5.1, 3.4, 1.5, 0.2],
       [5. , 3.5, 1.3, 0.3],
       [4.5, 2.3, 1.3, 0.3],
       [4.4, 3.2, 1.3, 0.2],
       [5. , 3.5, 1.6, 0.6],
       [5.1, 3.8, 1.9, 0.4],
       [4.8, 3. , 1.4, 0.3],
       [5.1, 3.8, 1.6, 0.2],
       [4.6, 3.2, 1.4, 0.2],
       [5.3, 3.7, 1.5, 0.2],
       [5. , 3.3, 1.4, 0.2],
       [7. , 3.2, 4.7, 1.4],
       [6.4, 3.2, 4.5, 1.5],
       [6.9, 3.1, 4.9, 1.5],
       [5.5, 2.3, 4. , 1.3],
       [6.5, 2.8, 4.6, 1.5],
       [5.7, 2.8, 4.5, 1.3],
       [6.3, 3.3, 4.7, 1.6],
       [4.9, 2.4, 3.3, 1. ],
       [6.6, 2.9, 4.6, 1.3],
       [5.2, 2.7, 3.9, 1.4],
       [5. , 2. , 3.5, 1. ],
       [5.9, 3. , 4.2, 1.5],
       [6. , 2.2, 4. , 1. ],
       [6.1, 2.9, 4.7, 1.4],
       [5.6, 2.9, 3.6, 1.3],
       [6.7, 3.1, 4.4, 1.4],
       [5.6, 3. , 4.5, 1.5],
       [5.8, 2.7, 4.1, 1. ],
       [6.2, 2.2, 4.5, 1.5],
       [5.6, 2.5, 3.9, 1.1],
       [5.9, 3.2, 4.8, 1.8],
       [6.1, 2.8, 4. , 1.3],
       [6.3, 2.5, 4.9, 1.5],
       [6.1, 2.8, 4.7, 1.2],
       [6.4, 2.9, 4.3, 1.3],
       [6.6, 3. , 4.4, 1.4],
       [6.8, 2.8, 4.8, 1.4],
       [6.7, 3. , 5. , 1.7],
       [6. , 2.9, 4.5, 1.5],
       [5.7, 2.6, 3.5, 1. ],
       [5.5, 2.4, 3.8, 1.1],
       [5.5, 2.4, 3.7, 1. ],
       [5.8, 2.7, 3.9, 1.2],
       [6. , 2.7, 5.1, 1.6],
       [5.4, 3. , 4.5, 1.5],
       [6. , 3.4, 4.5, 1.6],
       [6.7, 3.1, 4.7, 1.5],
       [6.3, 2.3, 4.4, 1.3],
       [5.6, 3. , 4.1, 1.3],
       [5.5, 2.5, 4. , 1.3],
       [5.5, 2.6, 4.4, 1.2],
       [6.1, 3. , 4.6, 1.4],
       [5.8, 2.6, 4. , 1.2],
       [5. , 2.3, 3.3, 1. ],
       [5.6, 2.7, 4.2, 1.3],
       [5.7, 3. , 4.2, 1.2],
       [5.7, 2.9, 4.2, 1.3],
       [6.2, 2.9, 4.3, 1.3],
       [5.1, 2.5, 3. , 1.1],
       [5.7, 2.8, 4.1, 1.3],
       [6.3, 3.3, 6. , 2.5],
       [5.8, 2.7, 5.1, 1.9],
       [7.1, 3. , 5.9, 2.1],
       [6.3, 2.9, 5.6, 1.8],
       [6.5, 3. , 5.8, 2.2],
       [7.6, 3. , 6.6, 2.1],
       [4.9, 2.5, 4.5, 1.7],
       [7.3, 2.9, 6.3, 1.8],
       [6.7, 2.5, 5.8, 1.8],
       [7.2, 3.6, 6.1, 2.5],
       [6.5, 3.2, 5.1, 2. ],
       [6.4, 2.7, 5.3, 1.9],
       [6.8, 3. , 5.5, 2.1],
       [5.7, 2.5, 5. , 2. ],
       [5.8, 2.8, 5.1, 2.4],
       [6.4, 3.2, 5.3, 2.3],
       [6.5, 3. , 5.5, 1.8],
       [7.7, 3.8, 6.7, 2.2],
       [7.7, 2.6, 6.9, 2.3],
       [6. , 2.2, 5. , 1.5],
       [6.9, 3.2, 5.7, 2.3],
       [5.6, 2.8, 4.9, 2. ],
       [7.7, 2.8, 6.7, 2. ],
       [6.3, 2.7, 4.9, 1.8],
       [6.7, 3.3, 5.7, 2.1],
       [7.2, 3.2, 6. , 1.8],
       [6.2, 2.8, 4.8, 1.8],
       [6.1, 3. , 4.9, 1.8],
       [6.4, 2.8, 5.6, 2.1],
       [7.2, 3. , 5.8, 1.6],
       [7.4, 2.8, 6.1, 1.9],
       [7.9, 3.8, 6.4, 2. ],
       [6.4, 2.8, 5.6, 2.2],
       [6.3, 2.8, 5.1, 1.5],
       [6.1, 2.6, 5.6, 1.4],
       [7.7, 3. , 6.1, 2.3],
       [6.3, 3.4, 5.6, 2.4],
       [6.4, 3.1, 5.5, 1.8],
       [6. , 3. , 4.8, 1.8],
       [6.9, 3.1, 5.4, 2.1],
       [6.7, 3.1, 5.6, 2.4],
       [6.9, 3.1, 5.1, 2.3],
       [5.8, 2.7, 5.1, 1.9],
       [6.8, 3.2, 5.9, 2.3],
       [6.7, 3.3, 5.7, 2.5],
       [6.7, 3. , 5.2, 2.3],
       [6.3, 2.5, 5. , 1.9],
       [6.5, 3. , 5.2, 2. ],
       [6.2, 3.4, 5.4, 2.3],
       [5.9, 3. , 5.1, 1.8]])
```

In [49]:

```python
from sklearn.model_selection import train_test_split

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.3, random_state=0)
```

In [50]:

```python
X_train
```

Out[50]:

```
array([[5. , 2. , 3.5, 1. ],
       [6.5, 3. , 5.5, 1.8],
       [6.7, 3.3, 5.7, 2.5],
       [6. , 2.2, 5. , 1.5],
       [6.7, 2.5, 5.8, 1.8],
       [5.6, 2.5, 3.9, 1.1],
       [7.7, 3. , 6.1, 2.3],
       [6.3, 3.3, 4.7, 1.6],
       [5.5, 2.4, 3.8, 1.1],
       [6.3, 2.7, 4.9, 1.8],
       [6.3, 2.8, 5.1, 1.5],
       [4.9, 2.5, 4.5, 1.7],
       [6.3, 2.5, 5. , 1.9],
       [7. , 3.2, 4.7, 1.4],
       [6.5, 3. , 5.2, 2. ],
       [6. , 3.4, 4.5, 1.6],
       [4.8, 3.1, 1.6, 0.2],
       [5.8, 2.7, 5.1, 1.9],
       [5.6, 2.7, 4.2, 1.3],
       [5.6, 2.9, 3.6, 1.3],
       [5.5, 2.5, 4. , 1.3],
       [6.1, 3. , 4.6, 1.4],
       [7.2, 3.2, 6. , 1.8],
       [5.3, 3.7, 1.5, 0.2],
       [4.3, 3. , 1.1, 0.1],
       [6.4, 2.7, 5.3, 1.9],
       [5.7, 3. , 4.2, 1.2],
       [5.4, 3.4, 1.7, 0.2],
       [5.7, 4.4, 1.5, 0.4],
       [6.9, 3.1, 4.9, 1.5],
       [4.6, 3.1, 1.5, 0.2],
       [5.9, 3. , 5.1, 1.8],
       [5.1, 2.5, 3. , 1.1],
       [4.6, 3.4, 1.4, 0.3],
       [6.2, 2.2, 4.5, 1.5],
       [7.2, 3.6, 6.1, 2.5],
       [5.7, 2.9, 4.2, 1.3],
       [4.8, 3. , 1.4, 0.1],
       [7.1, 3. , 5.9, 2.1],
       [6.9, 3.2, 5.7, 2.3],
       [6.5, 3. , 5.8, 2.2],
       [6.4, 2.8, 5.6, 2.1],
       [5.1, 3.8, 1.6, 0.2],
       [4.8, 3.4, 1.6, 0.2],
       [6.5, 3.2, 5.1, 2. ],
       [6.7, 3.3, 5.7, 2.1],
       [4.5, 2.3, 1.3, 0.3],
       [6.2, 3.4, 5.4, 2.3],
       [4.9, 3. , 1.4, 0.2],
       [5.7, 2.5, 5. , 2. ],
       [6.9, 3.1, 5.4, 2.1],
       [4.4, 3.2, 1.3, 0.2],
       [5. , 3.6, 1.4, 0.2],
       [7.2, 3. , 5.8, 1.6],
       [5.1, 3.5, 1.4, 0.3],
       [4.4, 3. , 1.3, 0.2],
       [5.4, 3.9, 1.7, 0.4],
       [5.5, 2.3, 4. , 1.3],
       [6.8, 3.2, 5.9, 2.3],
       [7.6, 3. , 6.6, 2.1],
       [5.1, 3.5, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5.2, 3.4, 1.4, 0.2],
       [5.7, 2.8, 4.5, 1.3],
       [6.6, 3. , 4.4, 1.4],
       [5. , 3.2, 1.2, 0.2],
       [5.1, 3.3, 1.7, 0.5],
       [6.4, 2.9, 4.3, 1.3],
       [5.4, 3.4, 1.5, 0.4],
       [7.7, 2.6, 6.9, 2.3],
       [4.9, 2.4, 3.3, 1. ],
       [7.9, 3.8, 6.4, 2. ],
       [6.7, 3.1, 4.4, 1.4],
       [5.2, 4.1, 1.5, 0.1],
       [6. , 3. , 4.8, 1.8],
       [5.8, 4. , 1.2, 0.2],
       [7.7, 2.8, 6.7, 2. ],
       [5.1, 3.8, 1.5, 0.3],
       [4.7, 3.2, 1.6, 0.2],
       [7.4, 2.8, 6.1, 1.9],
       [5. , 3.3, 1.4, 0.2],
       [6.3, 3.4, 5.6, 2.4],
       [5.7, 2.8, 4.1, 1.3],
       [5.8, 2.7, 3.9, 1.2],
       [5.7, 2.6, 3.5, 1. ],
       [6.4, 3.2, 5.3, 2.3],
       [6.7, 3. , 5.2, 2.3],
       [6.3, 2.5, 4.9, 1.5],
       [6.7, 3. , 5. , 1.7],
       [5. , 3. , 1.6, 0.2],
       [5.5, 2.4, 3.7, 1. ],
       [6.7, 3.1, 5.6, 2.4],
       [5.8, 2.7, 5.1, 1.9],
       [5.1, 3.4, 1.5, 0.2],
       [6.6, 2.9, 4.6, 1.3],
       [5.6, 3. , 4.1, 1.3],
       [5.9, 3.2, 4.8, 1.8],
       [6.3, 2.3, 4.4, 1.3],
       [5.5, 3.5, 1.3, 0.2],
       [5.1, 3.7, 1.5, 0.4],
       [4.9, 3.1, 1.5, 0.1],
       [6.3, 2.9, 5.6, 1.8],
       [5.8, 2.7, 4.1, 1. ],
       [7.7, 3.8, 6.7, 2.2],
       [4.6, 3.2, 1.4, 0.2]])
```

In [51]:

```python
X_train.shape
```

Out[51]:

```
(105, 4)
```

In [52]:

```python
X_test.shape
```

Out[52]:

```
(45, 4)
```

In [53]:

```python
Y_test.shape
```

Out[53]:

```
(45,)
```

In [54]:

```python
Y_train.shape
```

Out[54]:

```
(105,)
```

In [55]:

```python
#training the model

from sklearn.preprocessing import StandardScaler
standard_scaler = StandardScaler().fit(X_train)
X_train_std = standard_scaler.transform(X_train)
X_test_std = standard_scaler.transform(X_test)
```

In [56]:

```python
X_train_std
```

Out[56]:

```
array([[-1.02366372, -2.37846268, -0.18295039, -0.29145882],
       [ 0.69517462, -0.10190314,  0.93066067,  0.73721938],
       [ 0.92435306,  0.58106472,  1.04202177,  1.6373128 ],
       [ 0.1222285 , -1.92315077,  0.6522579 ,  0.35146505],
       [ 0.92435306, -1.24018291,  1.09770233,  0.73721938],
       [-0.33612839, -1.24018291,  0.03977182, -0.16287405],
       [ 2.07024529, -0.10190314,  1.26474398,  1.38014325],
       [ 0.46599617,  0.58106472,  0.48521625,  0.48004983],
       [-0.45071761, -1.46783886, -0.01590873, -0.16287405],
       [ 0.46599617, -0.784871  ,  0.59657735,  0.73721938],
       [ 0.46599617, -0.55721505,  0.70793846,  0.35146505],
       [-1.13825295, -1.24018291,  0.37385514,  0.6086346 ],
       [ 0.46599617, -1.24018291,  0.6522579 ,  0.86580415],
       [ 1.26812073,  0.35340877,  0.48521625,  0.22288028],
       [ 0.69517462, -0.10190314,  0.76361901,  0.99438893],
       [ 0.1222285 ,  0.80872067,  0.37385514,  0.48004983],
       [-1.25284217,  0.12575281, -1.24088089, -1.32013702],
       [-0.10694994, -0.784871  ,  0.70793846,  0.86580415],
       [-0.33612839, -0.784871  ,  0.20681348,  0.0942955 ],
       [-0.33612839, -0.32955909, -0.12726983,  0.0942955 ],
       [-0.45071761, -1.24018291,  0.09545238,  0.0942955 ],
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       [-0.22153916,  3.08528021, -1.29656144, -1.06296747],
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       [-1.48202061,  0.12575281, -1.29656144, -1.32013702],
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       [ 0.69517462, -0.10190314,  1.09770233,  1.25155848],
       [ 0.5805854 , -0.55721505,  0.98634122,  1.1229737 ],
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       [ 0.92435306,  0.58106472,  1.04202177,  1.1229737 ],
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       [-1.71119906,  0.35340877, -1.40792255, -1.32013702],
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       [-1.36743139,  0.35340877, -1.24088089, -1.32013702],
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       [ 0.5805854 ,  0.35340877,  0.81929956,  1.38014325],
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       [ 0.46599617, -1.24018291,  0.59657735,  0.35146505],
       [ 0.92435306, -0.10190314,  0.6522579 ,  0.6086346 ],
       [-1.02366372, -0.10190314, -1.24088089, -1.32013702],
       [-0.45071761, -1.46783886, -0.07158928, -0.29145882],
       [ 0.92435306,  0.12575281,  0.98634122,  1.50872803],
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       [ 0.80976384, -0.32955909,  0.42953569,  0.0942955 ],
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       [-0.9090745 ,  1.49168853, -1.29656144, -1.06296747],
       [-1.13825295,  0.12575281, -1.29656144, -1.4487218 ],
       [ 0.46599617, -0.32955909,  0.98634122,  0.73721938],
       [-0.10694994, -0.784871  ,  0.15113293, -0.29145882],
       [ 2.07024529,  1.71934449,  1.5988273 ,  1.25155848],
       [-1.48202061,  0.35340877, -1.35224199, -1.32013702]])
```

In [57]:

```python
Y_train
```

Out[57]:

```
array([1, 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 2, 2, 1, 2, 1, 0, 2, 1, 1, 1, 1,
       2, 0, 0, 2, 1, 0, 0, 1, 0, 2, 1, 0, 1, 2, 1, 0, 2, 2, 2, 2, 0, 0,
       2, 2, 0, 2, 0, 2, 2, 0, 0, 2, 0, 0, 0, 1, 2, 2, 0, 0, 0, 1, 1, 0,
       0, 1, 0, 2, 1, 2, 1, 0, 2, 0, 2, 0, 0, 2, 0, 2, 1, 1, 1, 2, 2, 1,
       1, 0, 1, 2, 2, 0, 1, 1, 1, 1, 0, 0, 0, 2, 1, 2, 0])
```

In [61]:

```python
#KNN Algo
```

In [58]:

```python
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=5)

knn.fit(X_train_std,Y_train)
```

Out[58]:

```
KNeighborsClassifier()
```

In [59]:

```python
predict_knn=knn.predict(X_test_std)
accuracy_knn=accuracy_score(Y_test,predict_knn)*100
```

In [60]:

```python
accuracy_knn
```

Out[60]:

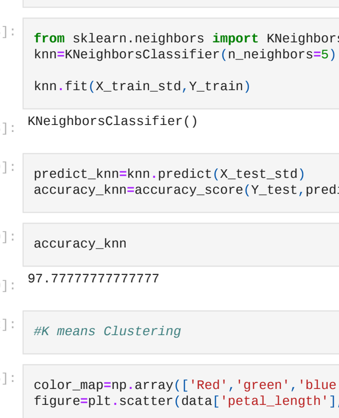
```
97.77777777777777
```

In [62]:

```python
#K means Clustering
```

In [65]:

```python
color_map=np.array(['Red','green','blue'])
figure=plt.scatter(data['petal_length'],data['petal_width'],c=color_map[Y],s=30)
```



In [66]:

```python
from sklearn.cluster import KMeans
k_means =KMeans(n_clusters=3,random_state=2, n_jobs=4)
k_means.fit(X)
```

```
c:\users\aakas\appdata\local\programs\python\python37\lib\site-packages\sklearn\cluster\_kmeans.py:793: FutureWarning: 'n_jobs' was deprecated in version 0.23 and will be removed i
n 1.0 (renaming of 0.25).
  " removed in 1.0 (renaming of 0.25).", FutureWarning)
```

Out[66]:

```
KMeans(n_clusters=3, n_jobs=4, random_state=2)
```

In [67]:

```python
y_k_means = k_means.fit_predict(X)
```

```
c:\users\aakas\appdata\local\programs\python\python37\lib\site-packages\sklearn\cluster\_kmeans.py:793: FutureWarning: 'n_jobs' was deprecated in version 0.23 and will be removed i
n 1.0 (renaming of 0.25).
  " removed in 1.0 (renaming of 0.25).", FutureWarning)
```

In [68]:

```python
centers = k_means.cluster_centers_
```

In [69]:

```python
centers
```

Out[69]:

```
array([[5.006     , 3.418     , 1.464     , 0.244     ],
       [5.9016129 , 2.7483871 , 4.39354839, 1.43387097],
       [6.85      , 3.07368421, 5.74210526, 2.07105263]])
```

In [71]:

```python
color_map=np.array(['Red','green','blue'])

labels=np.array(['Iris-setosa','Iris-virginica','Iris-versicolour'])
figure=plt.scatter(data['petal_length'],data['petal_width'],c=color_map[k_means.labels_],s=20)
```