**CFrom the given ‘Iris’ dataset, predict the optimum number of clusters
and represent it visually.**

Task 2-- The Spark Foundation

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Predict the percentage of an student based on the no. of study hours.

1. Used DecisionTreeClassifier to classifie the dataset
2. Using Python

1. Dataset : https://bit.ly/3kXTdox
2. The purpose is if we feed any new data to this classifier, it would be able to
predict the right class accordingly.

Importing all the important libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

In [2]:
```
df=pd.read_csv('Iris.csv')
df.head()
```

Out[2]:

	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

In [3]:
```
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 [5]:
```
df['Species'].unique()
```

Out[5]:
```
array(['Iris-setosa', 'Iris-versicolor', 'Iris-virginica'], dtype=object)
```

In [6]:
```
df['Species']=df['Species'].map({'Iris-setosa':0,'Iris-versicolor':1,'Iris-virginica':2})
```

In [7]:
```
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    int64
dtypes: float64(4), int64(2)
memory usage: 7.2 KB
```

In [8]:
```
df.isnull().sum()
```

Out[8]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [9]:
```
df.describe()
```

Out[9]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
count	150.000000	150.000000	150.000000	150.000000	150.000000	150.000000
mean	75.500000	5.843333	3.054000	3.758667	1.198667	1.000000
std	43.445368	0.828066	0.433594	1.764420	0.763161	0.819232
min	1.000000	4.300000	2.000000	1.000000	0.100000	0.000000
25%	38.250000	5.100000	2.800000	1.600000	0.300000	0.000000
50%	75.500000	5.800000	3.000000	4.350000	1.300000	1.000000
75%	112.750000	6.400000	3.300000	5.100000	1.800000	2.000000
max	150.000000	7.900000	4.400000	6.900000	2.500000	2.000000

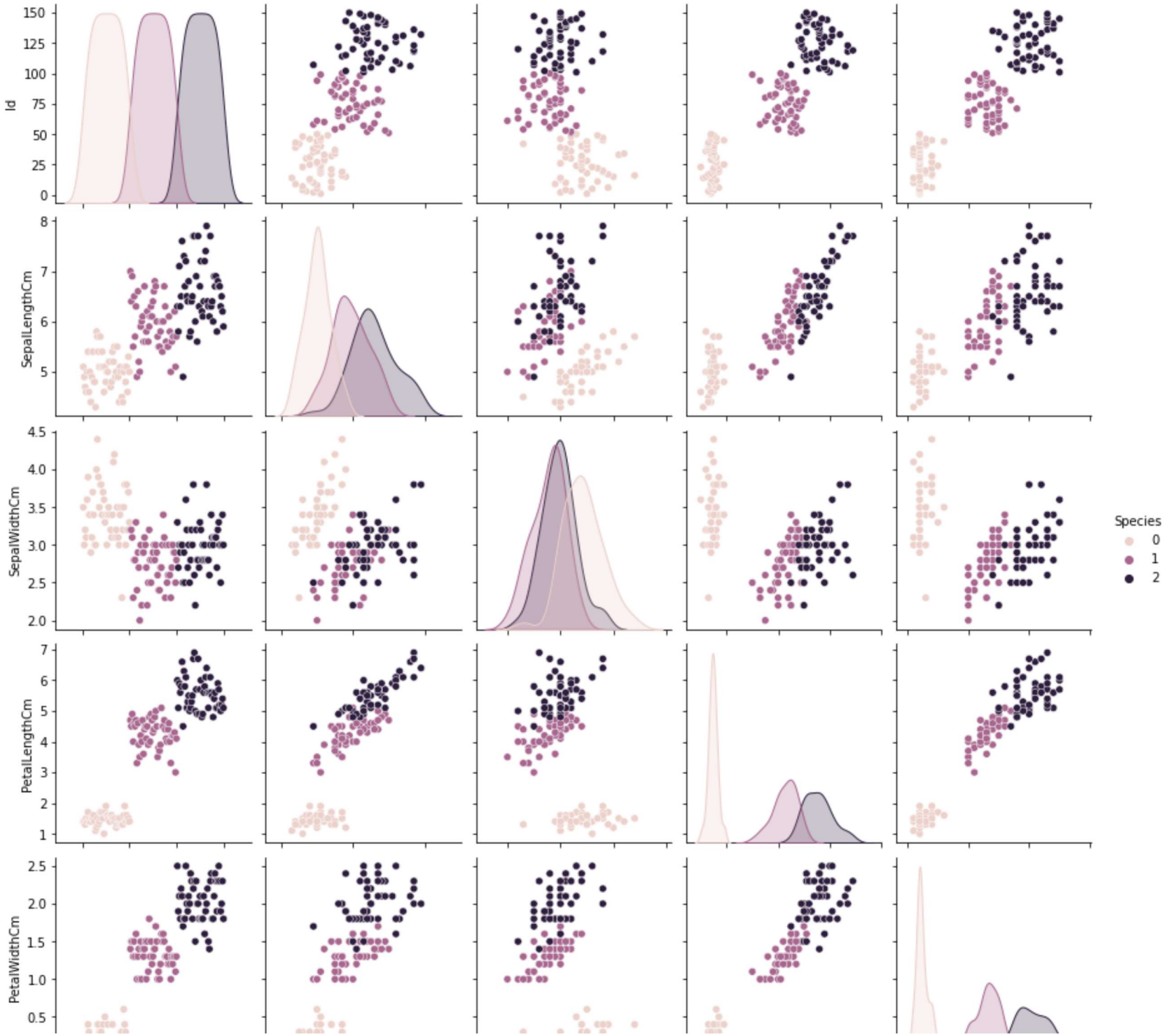
In [10]:
```
df.corr()
```

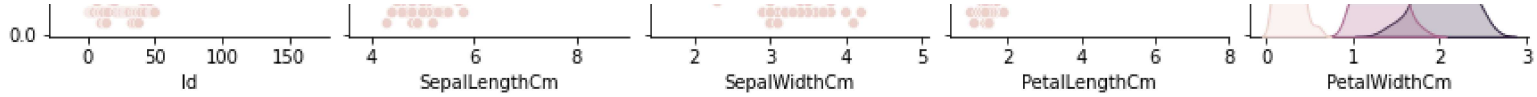
Out[10]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
Id	1.000000	0.716676	-0.397729	0.882747	0.899759	0.942830
SepalLengthCm	0.716676	1.000000	-0.109369	0.871754	0.817954	0.782561
SepalWidthCm	-0.397729	-0.109369	1.000000	-0.420516	-0.356544	-0.419446
PetalLengthCm	0.882747	0.871754	-0.420516	1.000000	0.962757	0.949043
PetalWidthCm	0.899759	0.817954	-0.356544	0.962757	1.000000	0.956464
Species	0.942830	0.782561	-0.419446	0.949043	0.956464	1.000000

In [11]:
```
sns.pairplot(df,hue='Species')
```

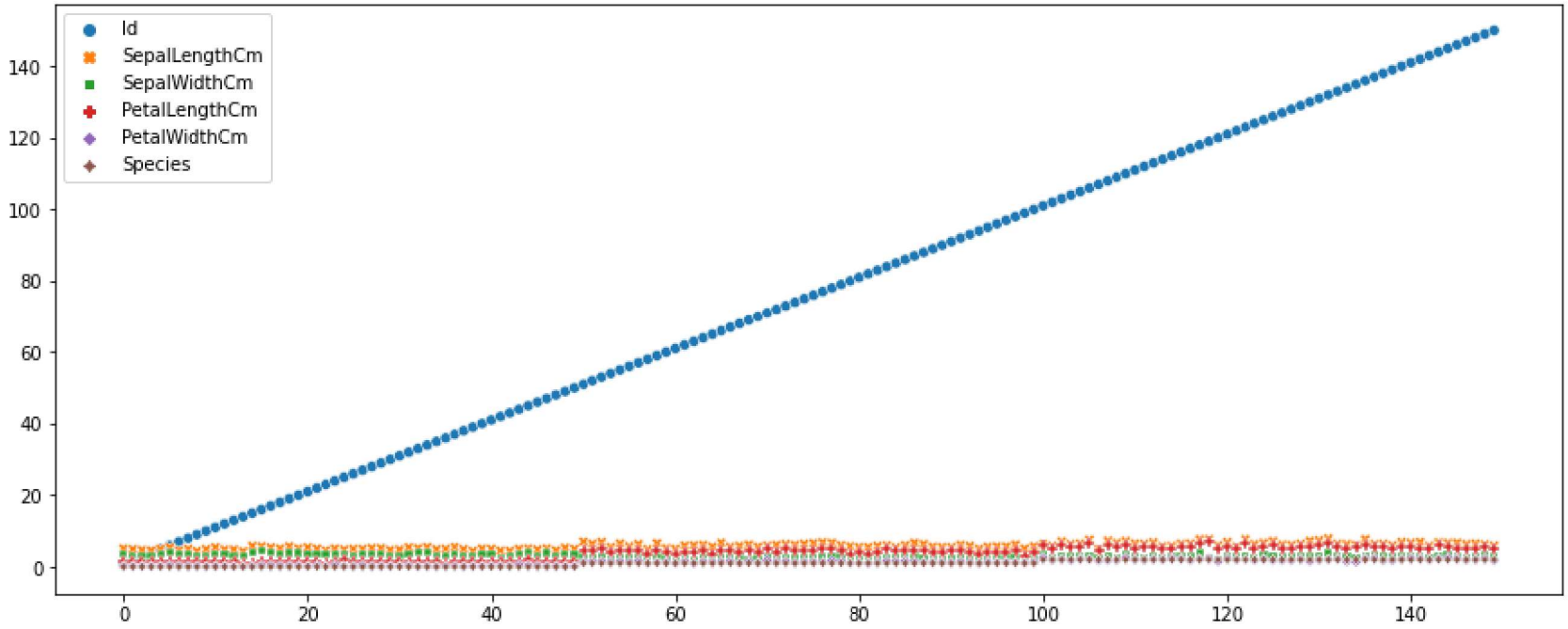
Out[11]:
```
<seaborn.axisgrid.PairGrid at 0x7ffb179654d0>
```


Id
SepalLengthCm
SepalWidthCm
PetalLengthCm
PetalWidthCm
Species
0
1
2



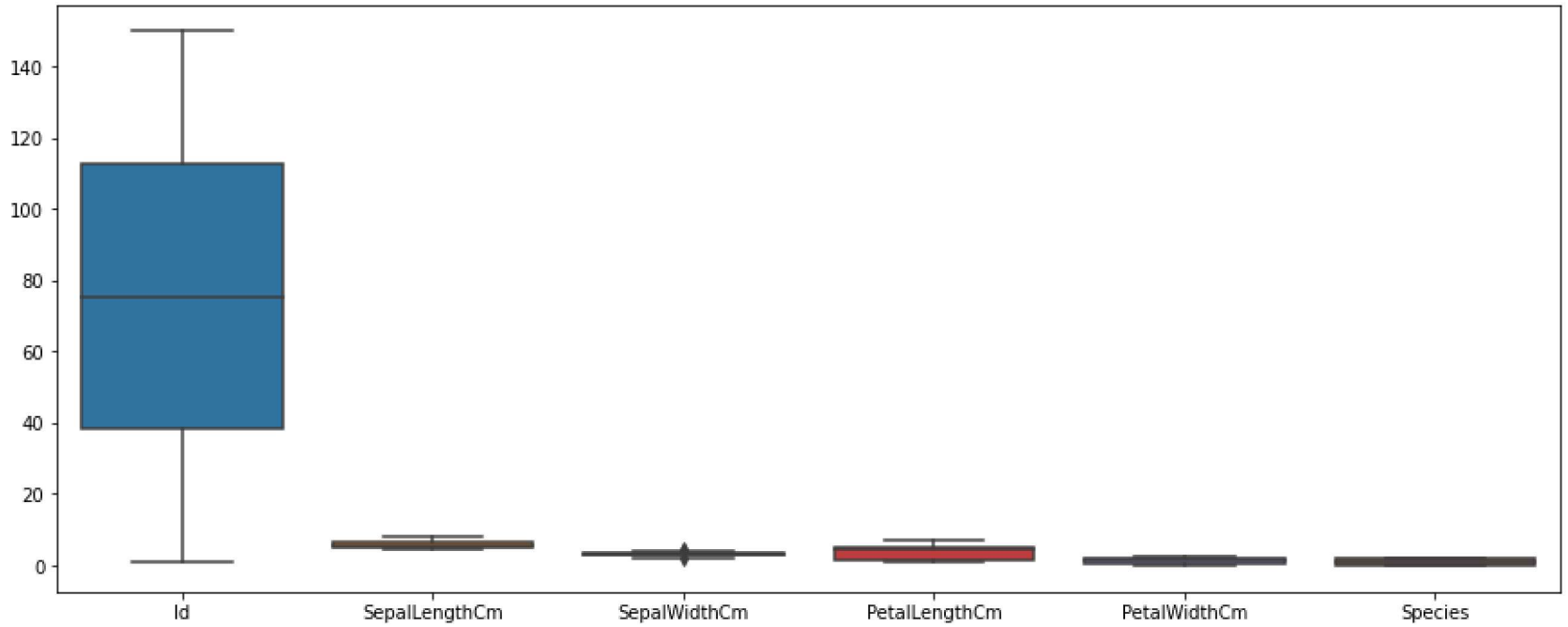
In [12]:
```
plt.figure(figsize=(15,6))
sns.scatterplot(data=df)
```

Out[12]: <matplotlib.axes._subplots.AxesSubplot at 0x7ffb0bc57790>



In [13]:
```
plt.figure(figsize=(15,6))
sns.boxplot(data=df)
```

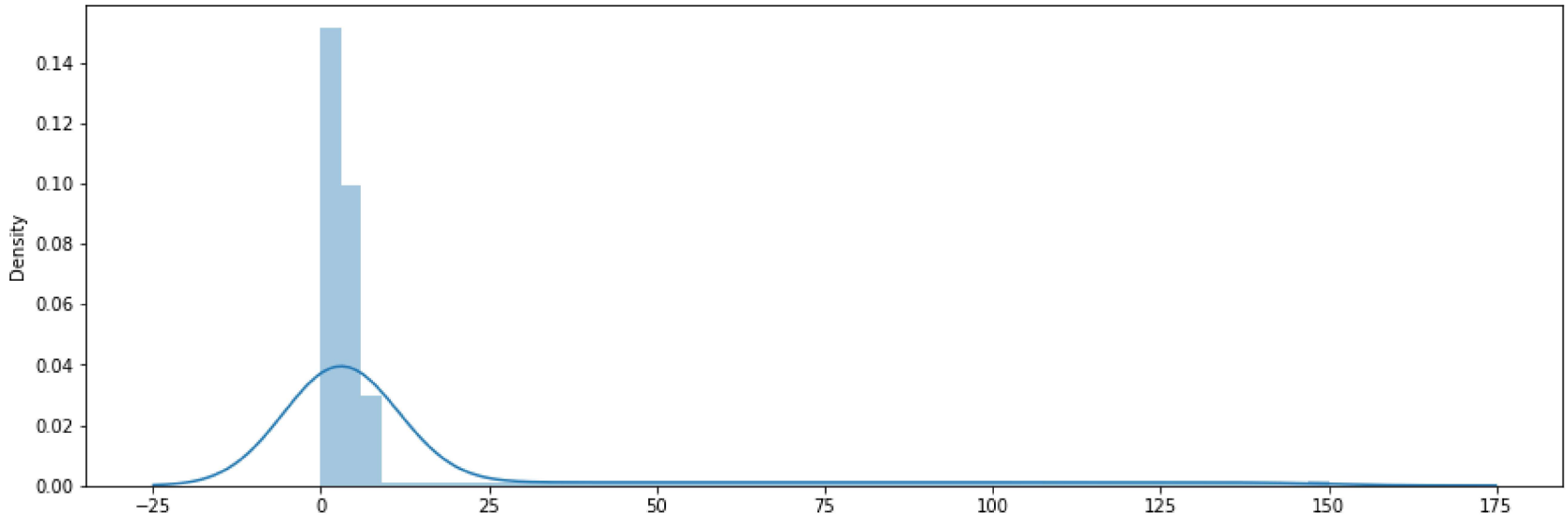
Out[13]: <matplotlib.axes._subplots.AxesSubplot at 0x7ffb0bae8850>



In [14]:
```
plt.figure(figsize=(15,5))
sns.distplot(df)
```

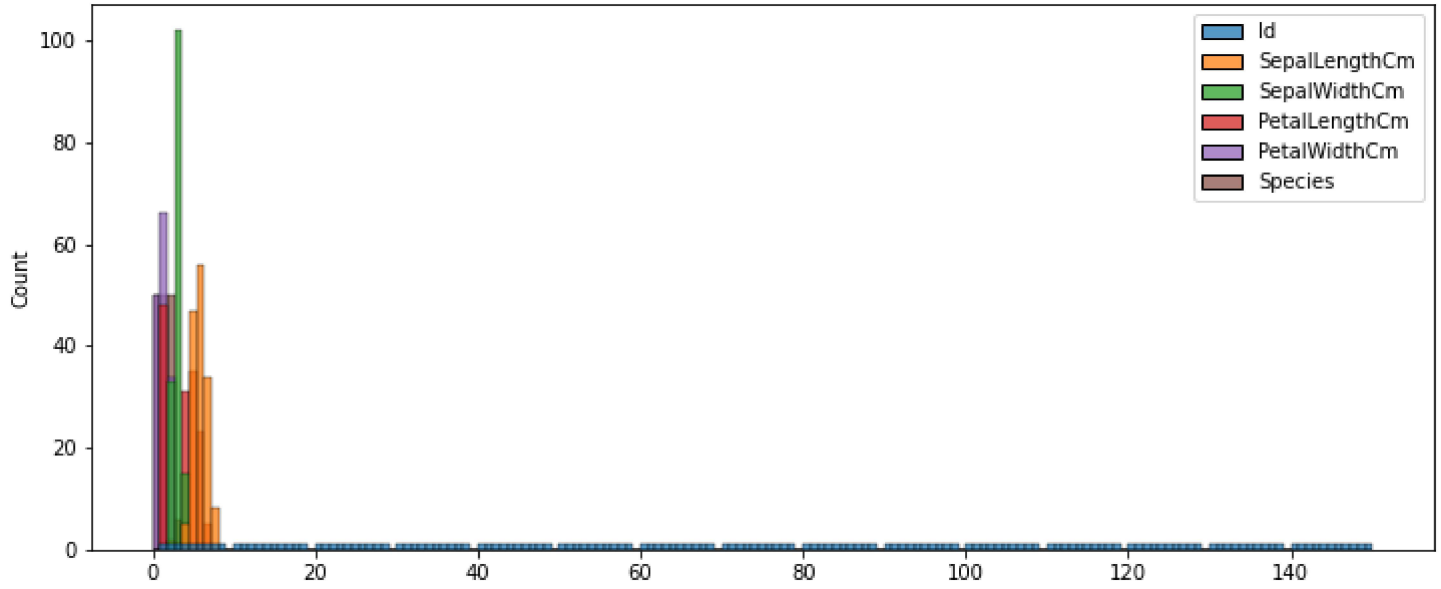
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x7ffb0babe0d0>



In [15]:
```
plt.figure(figsize=(12,5))
sns.histplot(df)
```

Out[15]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ffb09c8de90>
```

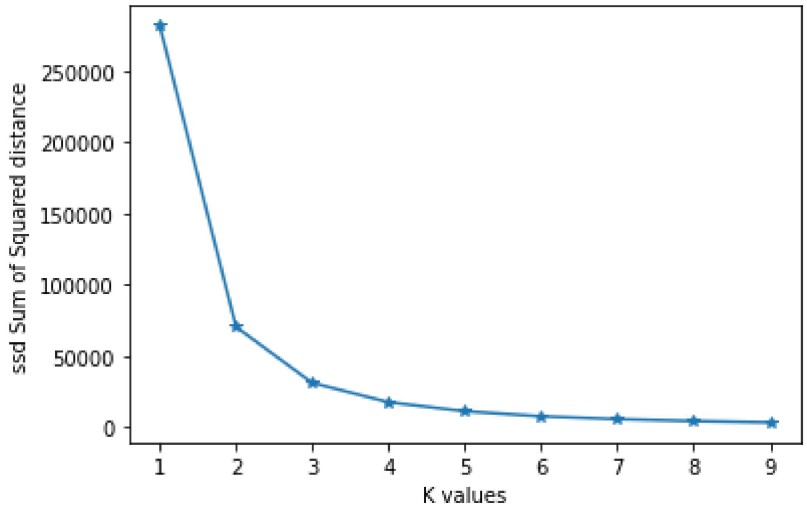


In [16]:
```
x=df
```

In [17]:
```
k=[1,2,3,4,5,6,7,8,9]
ssd=[]       # sum of squared distance
for i in k:
    model=KMeans(n_clusters=i)
    model.fit(x)
    ssd.append(model.inertia_)
```

In [18]:
```
plt.plot(k,ssd,marker='*')
plt.xticks(k)
plt.xlabel('K values')
plt.ylabel('ssd Sum of Squared distance')
```

Out[18]:
```
Text(0, 0.5, 'ssd Sum of Squared distance')
```



In [19]:
```
model=KMeans(n_clusters=4, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
model.fit(x)
y_kmeans=model.predict(x)
print(model.inertia_)
print(model.labels_)
```

```
17800.40525604552
[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
 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 3 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]
```

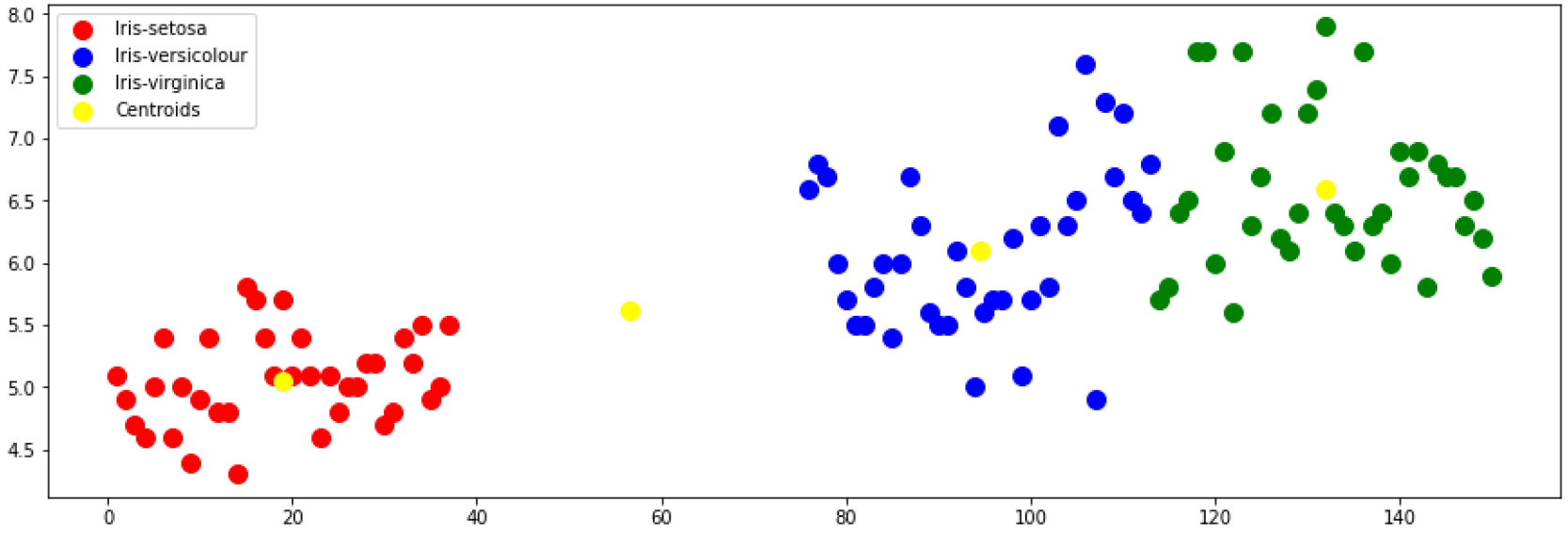
In [20]:
```
labels = model.labels_
centroid = model.cluster_centers_
```

In [21]:
```
x=np.array(x)
```

In [22]:
```
plt.figure(figsize=(15,5))
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Iris-setosa')
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1],
            s = 100, c = 'blue', label = 'Iris-versicolour')
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],
            s = 100, c = 'green', label = 'Iris-virginica')

# Plotting the centroids of the clusters
plt.scatter(model.cluster_centers_[:, 0], model.cluster_centers_[:,1],
            s = 100, c = 'yellow', label = 'Centroids')
plt.legend()
```

Out[22]: <matplotlib.legend.Legend at 0x7ffb095c7150>



In [22]: