In [ ]:

```
Name - Bodke Sairaj Nivrutti.
Class - BE Artificial Intelligence and Data Science.
Roll No. - 09
Practical No.04 - Clustering Analysis.
                  Implement K-Means clustering on Iris.csv dataset. Determine the number of clusters
                  using the elbow method.
```

In [1]:

```
# Import Required Libraries.
```

In [2]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
import seaborn as sns
```

In [3]:

```
# Load the Iris Dataset.
```

In [4]:

```
df = pd.read_csv(r"C:\Users\saira\Downloads\Iris (1).csv")
```

In [5]:

```
df
```

Out[5]:

	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

In [6]:

```
df.head()
```

Out[6]:

	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 [7]:

```
df.tail()
```

Out[7]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
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

In [8]:

```
len(df)
```

Out[8]:

```
150
```

In [9]:

```
df.shape
```

Out[9]:

```
(150, 6)
```

In [10]:

```
df.columns
```

Out[10]:
```
Index(['Id', 'SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm', 'PetalWidthCm',
       'Species'],
      dtype='object')
```

In [12]:
```
for i, col in enumerate(df.columns):
    print(f'coloumn number {1+i} is {col}')
```

```
coloumn number 1 is Id
coloumn number 2 is SepalLengthCm
coloumn number 3 is SepalWidthCm
coloumn number 4 is PetalLengthCm
coloumn number 5 is PetalWidthCm
coloumn number 6 is Species
```

In [13]:
```
df.dtypes
```

Out[13]:
```
Id                 int64
SepalLengthCm    float64
SepalWidthCm     float64
PetalLengthCm    float64
PetalWidthCm     float64
Species           object
dtype: object
```

In [15]:
```
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 [16]:
```
df.describe()
```

Out[16]:

	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 [17]:
```
# Checking the Missing Values.
```

In [18]:
```
df.isnull().sum()
```

Out[18]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [19]:
```
df.drop('Id', axis = 1, inplace = True)
```

In [20]:
```
df.head()
```

Out[20]:

	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

In [21]:

```
# K - Means Clustering.
```

In [22]:

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

Out[22]:

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

In [23]:

```
df['Species'].value_counts()
```

Out[23]:

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

In [24]:

```
# Splitting into Training and Target Data

# Target Data
target_data = df.iloc[:, 4]
target_data.head()
```

Out[24]:

```
0    Iris-setosa
1    Iris-setosa
2    Iris-setosa
3    Iris-setosa
4    Iris-setosa
Name: Species, dtype: object
```

In [27]:

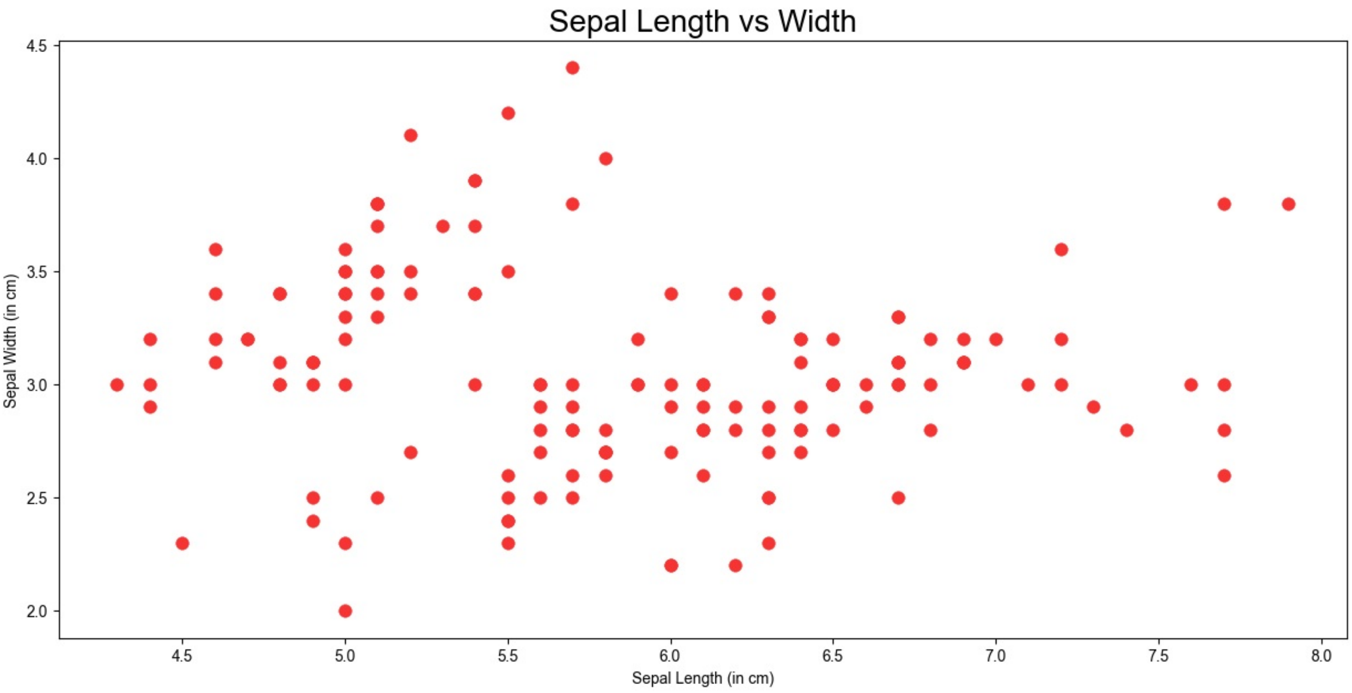
```
# Training Data
clustering_data = df.iloc[:,[0,1,2,3]]
clustering_data.head()
```

Out[27]:

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

In [29]:

```
fig, ax = plt.subplots(figsize = (15,7))
sns.set(font_scale = 1.5)
ax = sns.scatterplot(x = df['SepalLengthCm'], y = df['SepalWidthCm'], s = 70, color = '#f73434', edgecolor = '#
ax.set_ylabel('Sepal Width (in cm)')
ax.set_xlabel('Sepal Length (in cm)')
plt.title('Sepal Length vs Width', fontsize = 20)
plt.show()
```



In [30]:

```
# The Elbow Method.
```

In [48]:

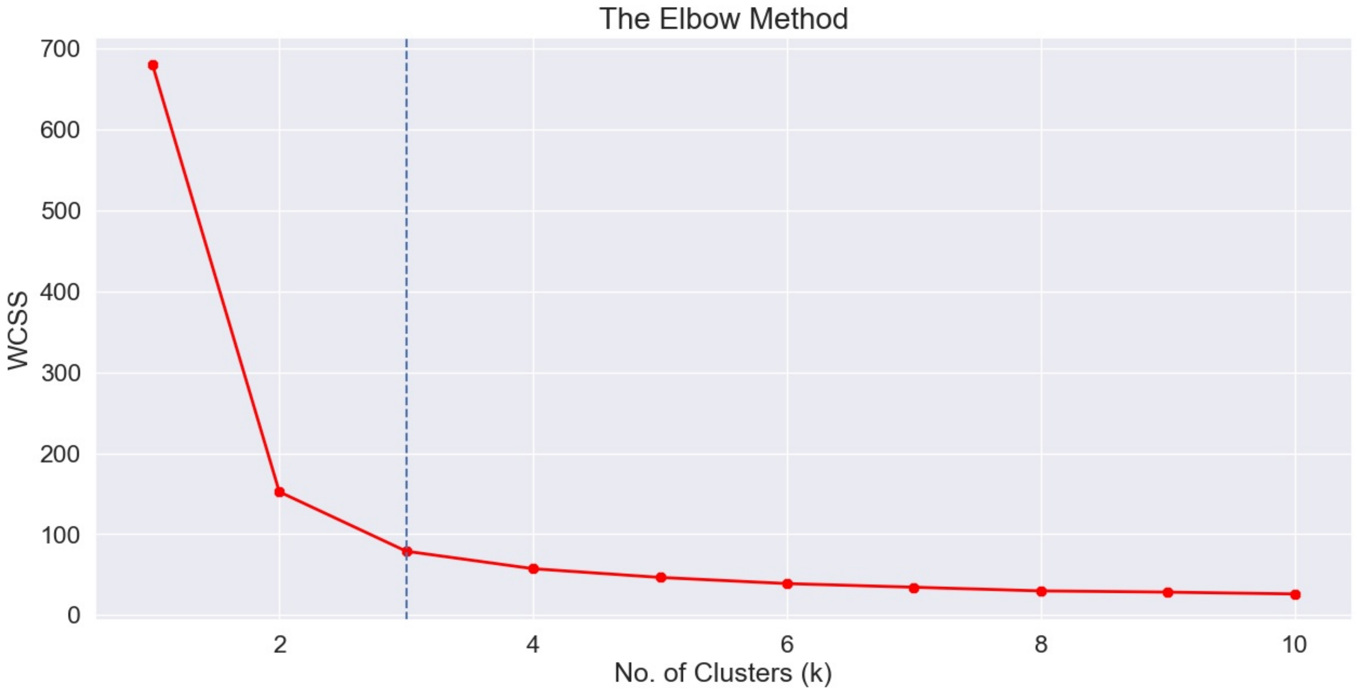
```
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)

from sklearn.cluster import KMeans
wcss = []
for i in range(1, 11):
    km = KMeans(i)
    km.fit(clustering_data)
    wcss.append(km.inertia_)
np.array(wcss)
```

Out[48]:

```
array([680.8244    , 152.36870648,  78.94084143,  57.31787321,
        46.53558205,  38.93096305,  34.42194767,  29.88140221,
        28.3706789 ,  26.10448016])
```

In [49]:

```
fig, ax = plt.subplots(figsize = (15, 7))
ax = plt.plot(range(1, 11), wcss, linewidth = 2, color = "red", marker = "8")
plt.axvline(x = 3, ls = '--')
plt.ylabel('WCSS')
plt.xlabel('No. of Clusters (k)')
plt.title('The Elbow Method', fontsize = 20)
plt.show()
```



In [50]:

```
# Clusters.
```

In [51]:

```
kms = KMeans(n_clusters = 3, init = 'k-means++')
kms.fit(clustering_data)
KMeans(n_clusters = 3)
clusters = clustering_data.copy()
clusters['Cluster_Prediction'] = kms.fit_predict(clustering_data)
clusters.head()
```

Out[51]:

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

In [52]:

```
kms.cluster_centers_
```

Out[52]:

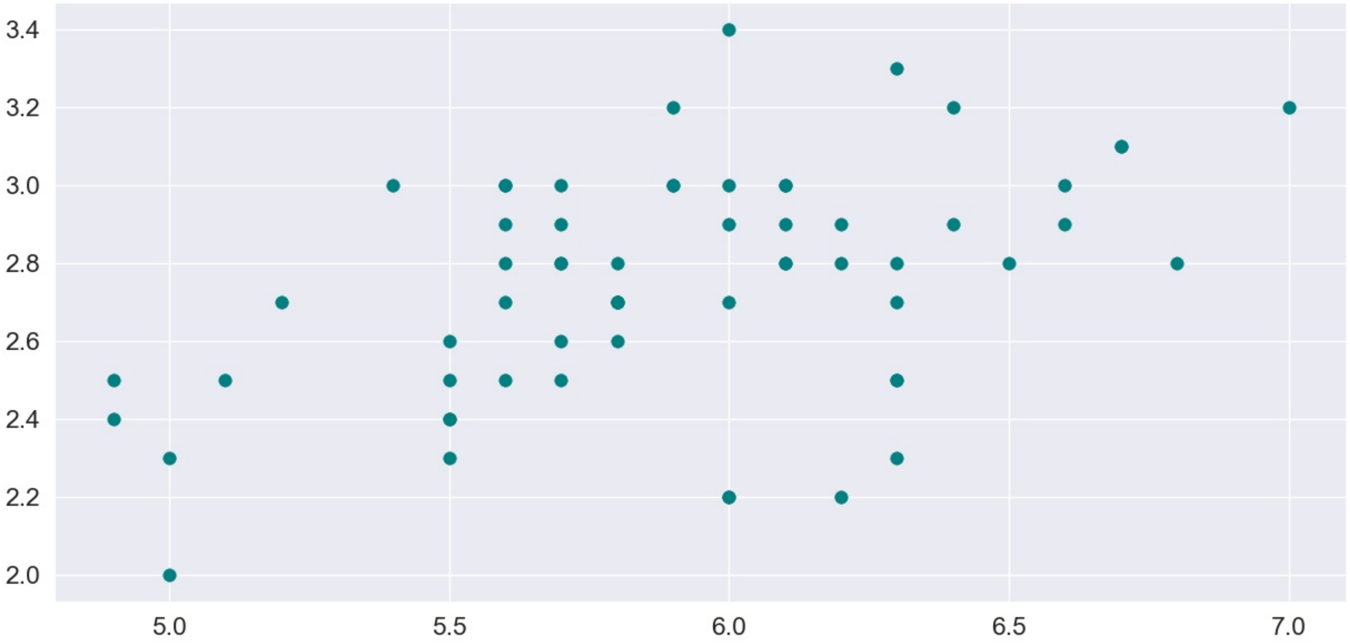
```
array([[5.9016129 , 2.7483871 , 4.39354839, 1.43387097],
       [5.006     , 3.418     , 1.464     , 0.244     ],
       [6.85      , 3.07368421, 5.74210526, 2.07105263]])
```

In [53]:

```
fig, ax = plt.subplots(figsize = (15,7))
plt.scatter(x = clusters[clusters['Cluster_Prediction'] == 0]['SepalLengthCm'],
           y = clusters[clusters['Cluster_Prediction'] == 0]['SepalWidthCm'],
           s = 70, edgecolor = 'teal', linewidth = 0.3, c = 'teal', label = 'Iris-versicolor')
```

Out[53]:

```
<matplotlib.collections.PathCollection at 0x1837c7ca620>
```

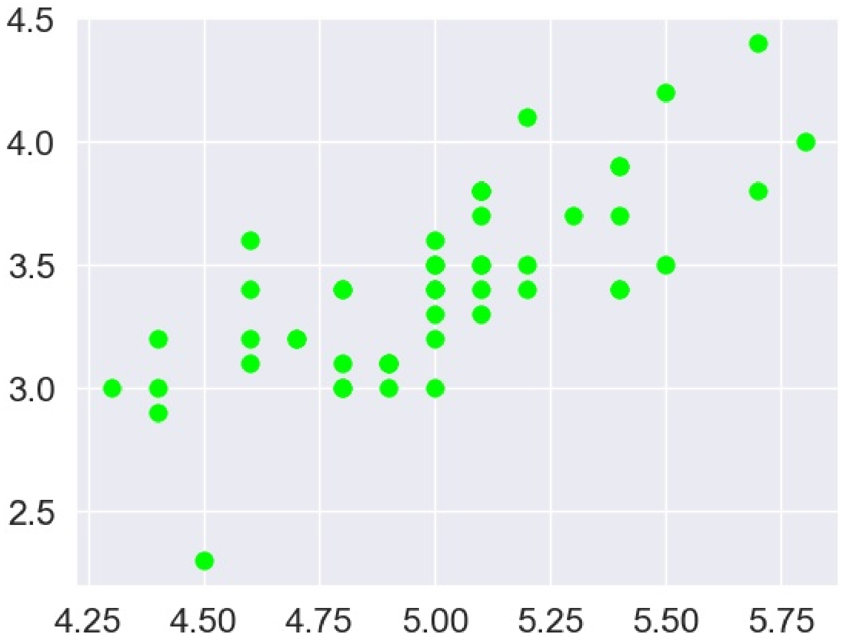


In [54]:

```
plt.scatter(x = clusters[clusters['Cluster_Prediction'] == 1]['SepalLengthCm'],
           y = clusters[clusters['Cluster_Prediction'] == 1]['SepalWidthCm'],
           s = 70, edgecolor = 'lime', linewidth = 0.3, c = 'lime', label = 'Iris-setosa')
```

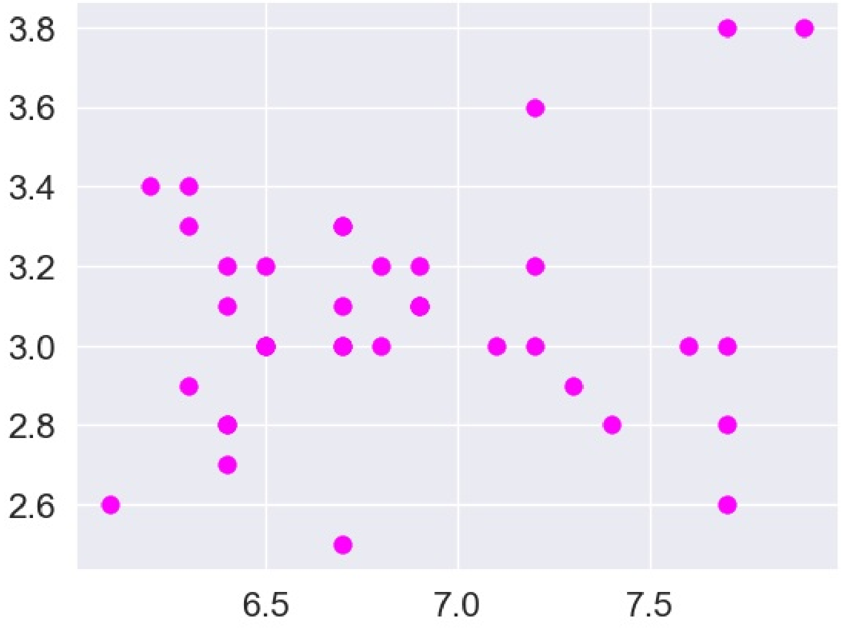
Out[54]:

```
<matplotlib.collections.PathCollection at 0x1837e894250>
```

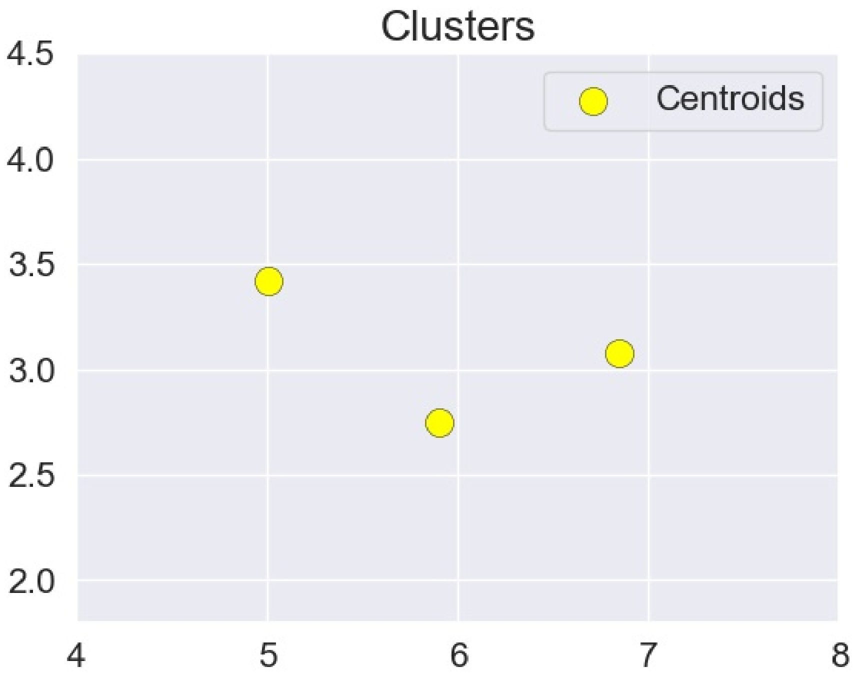


In [55]:
```
plt.scatter(x = clusters[clusters['Cluster_Prediction'] == 2]['SepalLengthCm'],
           y = clusters[clusters['Cluster_Prediction'] == 2]['SepalWidthCm'],
           s = 70, edgecolor = 'magenta', linewidth = 0.3, c = 'magenta', label = 'Iris-virginica')
```

Out[55]:
```
<matplotlib.collections.PathCollection at 0x1837e8fcfa0>
```



In [56]:
```
plt.scatter(x = kms.cluster_centers_[:, 0], y = kms.cluster_centers_[:, 1], s = 170, c = 'yellow',
            label = 'Centroids', edgecolor = 'black', linewidth = 0.3)
plt.legend(loc = 'upper right')
plt.xlim(4, 8)
plt.ylim(1.8, 4.5)
ax.set_ylabel('Sepal Width (in cm)')
ax.set_xlabel('Sepal Length(in cm)')
plt.title('Clusters', fontsize = 20)
plt.show()
```



In [ ]:

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