In [1]:
```
import numpy as np
import pandas as pd
from sklearn.preprocessing import LabelEncoder
import matplotlib.pyplot as plt
ir= pd.read_csv("C:\\Users\\dhima\\anaconda3\\6th Week\\Iris.csv")
ir1=ir.copy()
ir1
```

Out[1]:

	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 [2]:
```
ir1.isnull().sum()
```

Out[2]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [3]:
```
y_true=ir1['Species']
y_true
```

Out[3]:
```
0         Iris-setosa
1         Iris-setosa
2         Iris-setosa
3         Iris-setosa
4         Iris-setosa
            ...
145    Iris-virginica
146    Iris-virginica
147    Iris-virginica
148    Iris-virginica
149    Iris-virginica
Name: Species, Length: 150, dtype: object
```

Ques 1. Apply PCA and select first two directions to convert the data in to 2D. (Exclude the attribute “Species” for PCA)

In [4]:
```
ir2=ir1.iloc[0:,1:5]
ir2
```

Out[4]:

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

150 rows × 4 columns

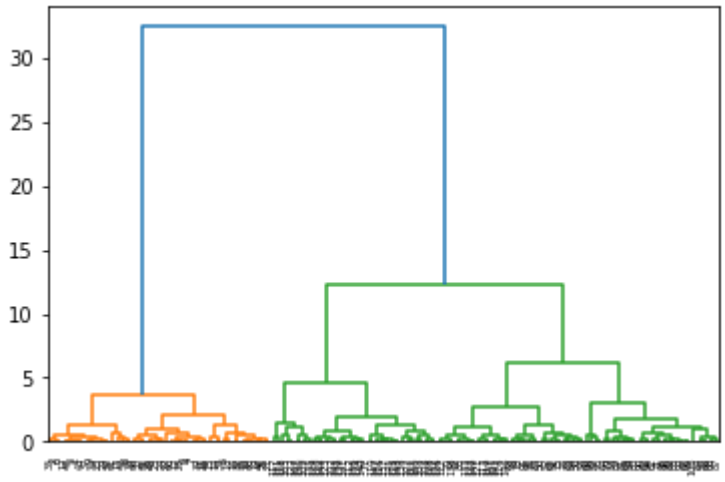
In [5]:
```
from sklearn.decomposition import PCA

pca = PCA(2)

df = pca.fit_transform(ir2)
pca.n_components_
df1=df.copy()
df.shape
```

Out[5]:
```
(150, 2)
```

2. Apply Agglomerative clustering with 3 clusters on the data. Plot the points in these clusters using different colors. Compare with the clustering obtained by K-means approach. (Use sklearn.cluster.AgglomerativeClustering)

In [6]:
```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
from sklearn.cluster import AgglomerativeClustering
import scipy.cluster.hierarchy as sch
```

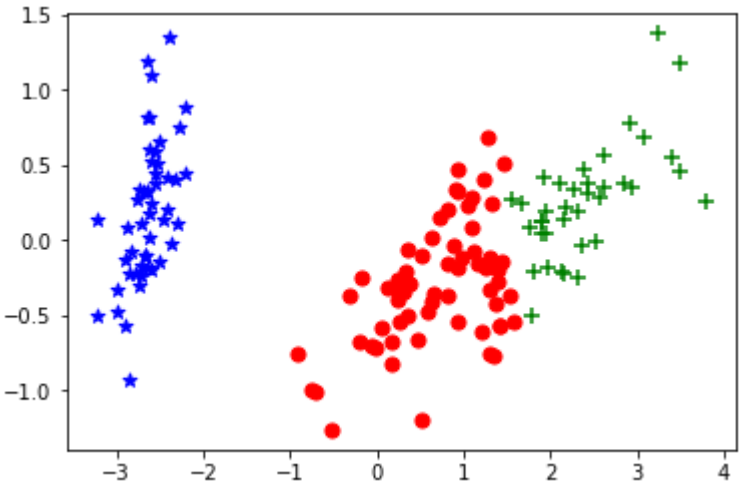
In [7]:
```
dendrogram = sch.dendrogram(sch.linkage(df, method='ward'))
```



In [8]:
```
model = AgglomerativeClustering(n_clusters=3, affinity='euclidean', linkage='ward
model.fit_predict(df)
labels = model.labels_

labels
```

Out[8]:
```
array([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, 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, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 2, 2, 2, 0, 2, 2,
       2, 2, 2, 0, 0, 2, 2, 2, 2, 0, 2, 0, 2, 0, 2, 2, 0, 0, 2, 2, 2,
       2, 0, 2, 2, 2, 2, 0, 2, 2, 2, 0, 2, 2, 2, 0, 2, 2, 0], dtype=int64)
```

In [9]:
```
plt.scatter(df[labels==0, 0], df[labels==0, 1], s=50, marker='o', color='red')
plt.scatter(df[labels==1, 0], df[labels==1, 1], s=50, marker='*', color='blue')
plt.scatter(df[labels==2, 0], df[labels==2, 1], s=50, marker='+', color='green')

plt.show()
```



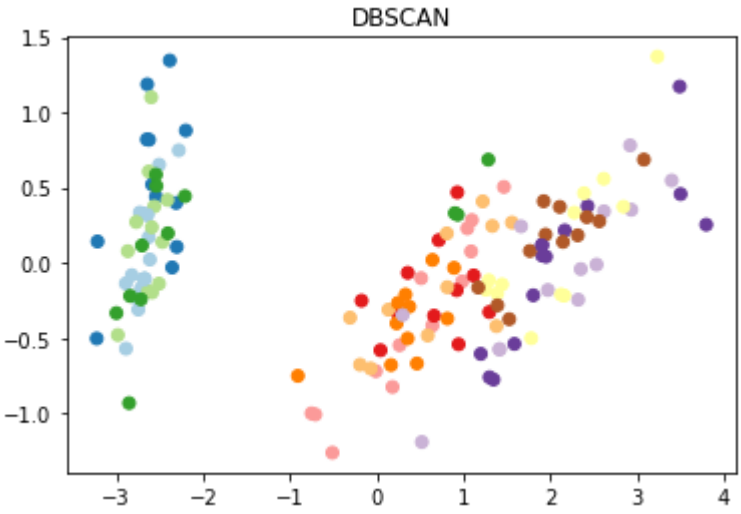
3. i) Apply DBSCAN clustering with default parameters and compare the results.

ii) Vary the parameter eps (maximum distance between two samples to be considered) to 0.05, 0.5 and 0.95 and observe the results. Vary min_samples (The number of samples in neighbourhood) to 1,5,10 and 20 and observe the resuts. (Use sklearn.cluster.DBSCAN)

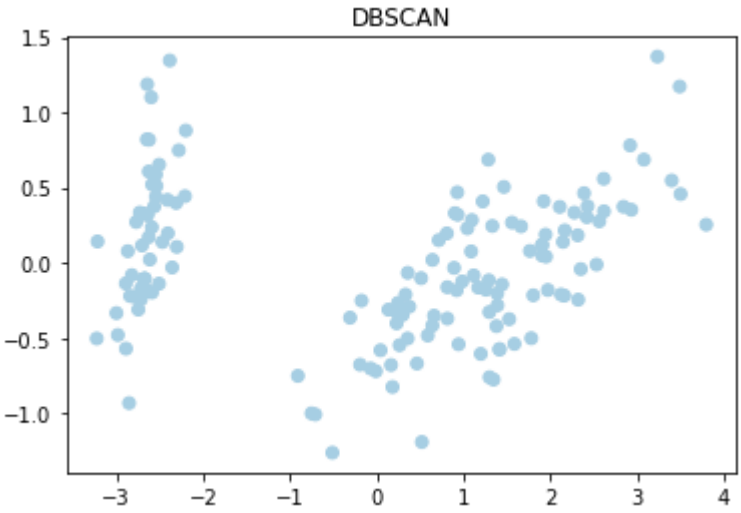
In [10]:
```
from sklearn.cluster import DBSCAN
def dbscan(X, eps, min_samples):
    #ss = StandardScaler()
    #X = ss.fit_transform(X)
    db = DBSCAN(eps=eps, min_samples=min_samples,metric='euclidean')
    db.fit(X)
    y_pred3 = db.fit_predict(X)
    plt.scatter(X[:,0], X[:,1],c=y_pred3, cmap='Paired')
    plt.title("DBSCAN")
```

eps=0.05

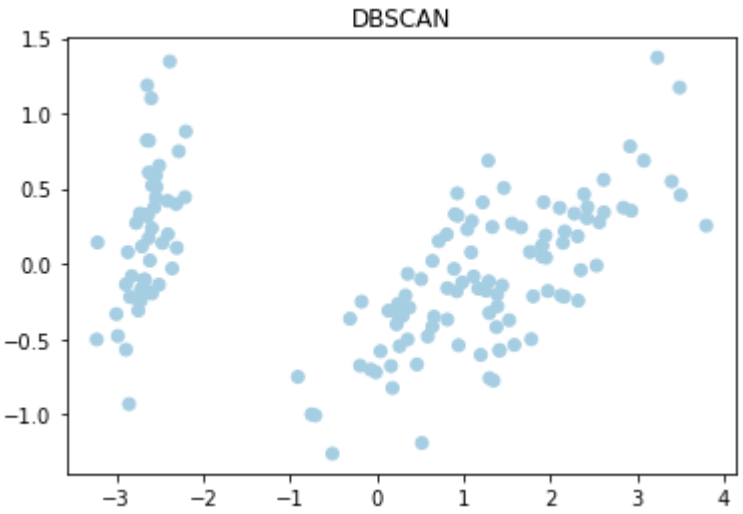
In [11]:
```
dbscan(df1, 0.05, 1)
```



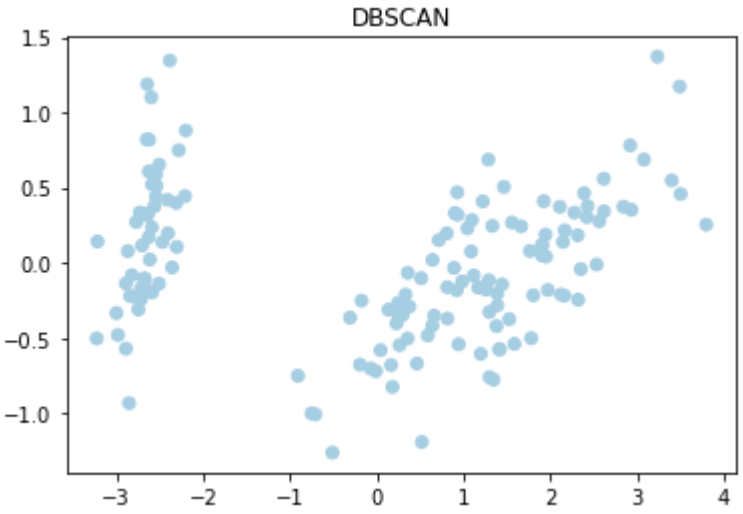
In [12]:
```
dbscan(df1, 0.05, 5)
```



In [13]:
```
dbscan(df1, 0.05, 10)
```

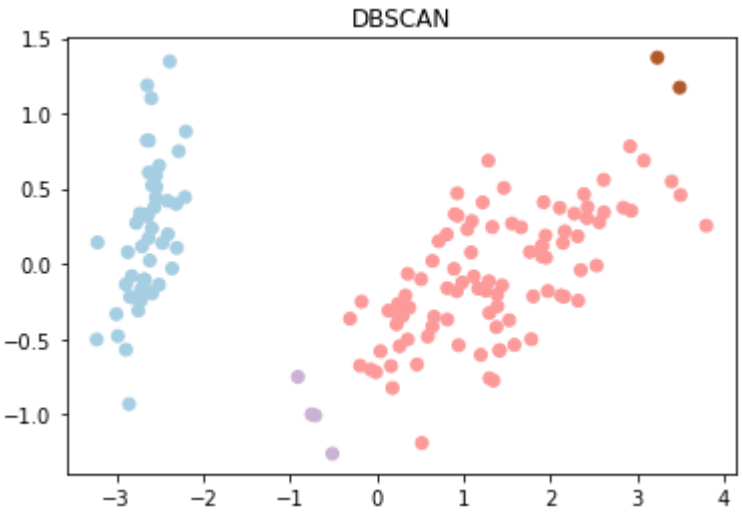


In [14]:
```
dbscan(df1, 0.05, 20)
```

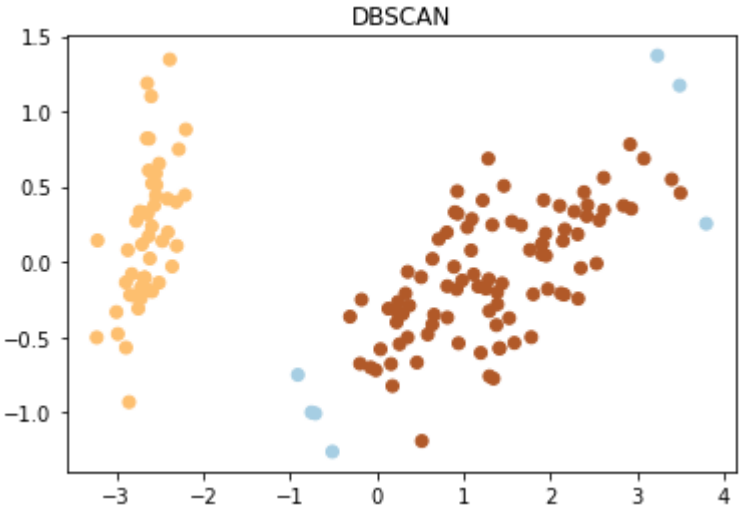


eps=0.5

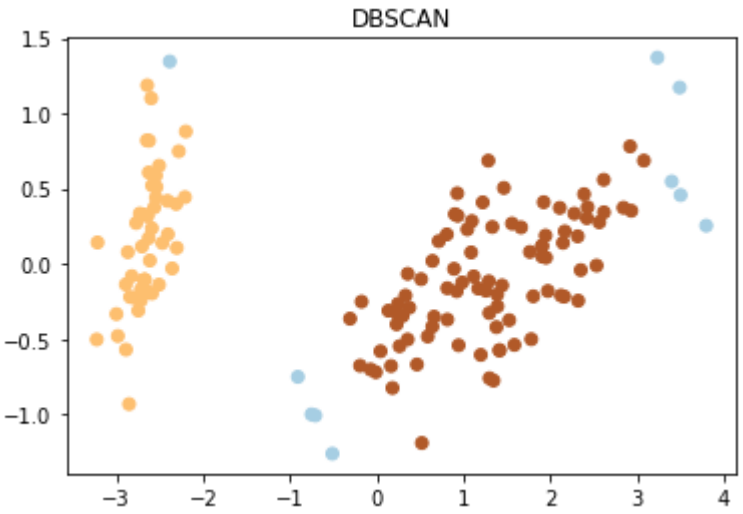
In [15]:
```
dbscan(df1, 0.5, 1)
```



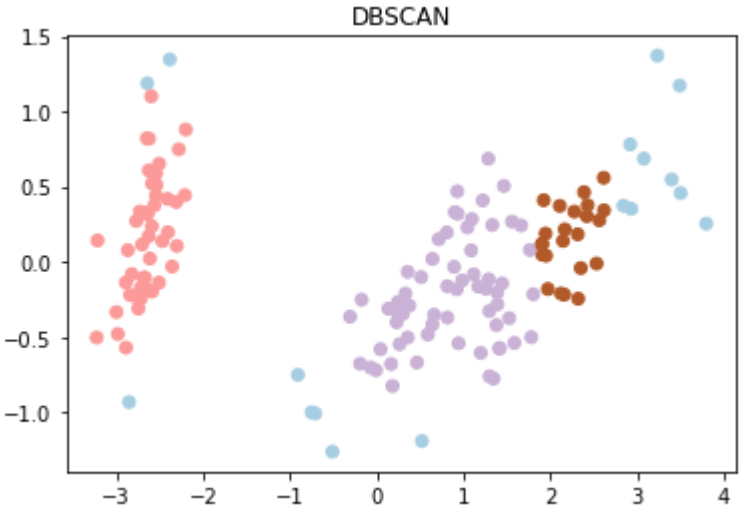
In [16]:
```
dbscan(df1, 0.5, 5)
```



In [17]:
```
dbscan(df1, 0.5, 10)
```

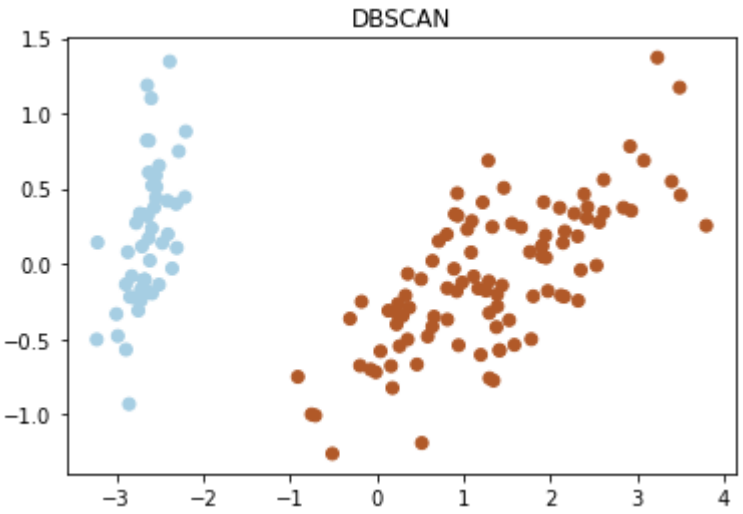


In [18]:
```
dbscan(df1, 0.5, 20)
```

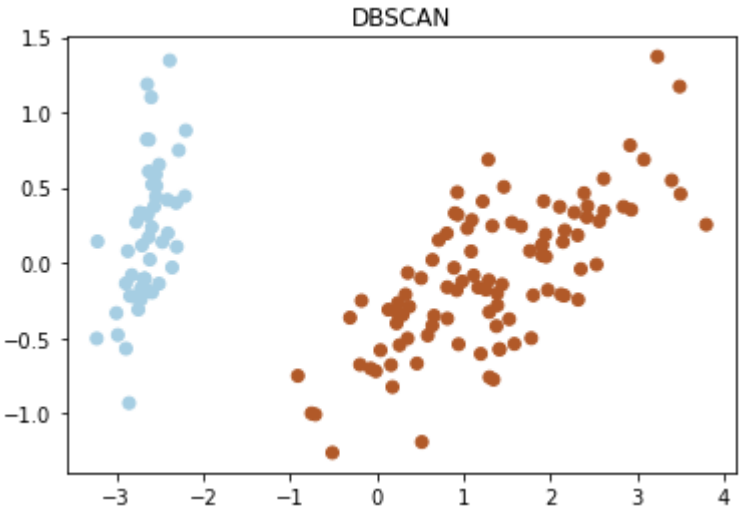


eps=0.95

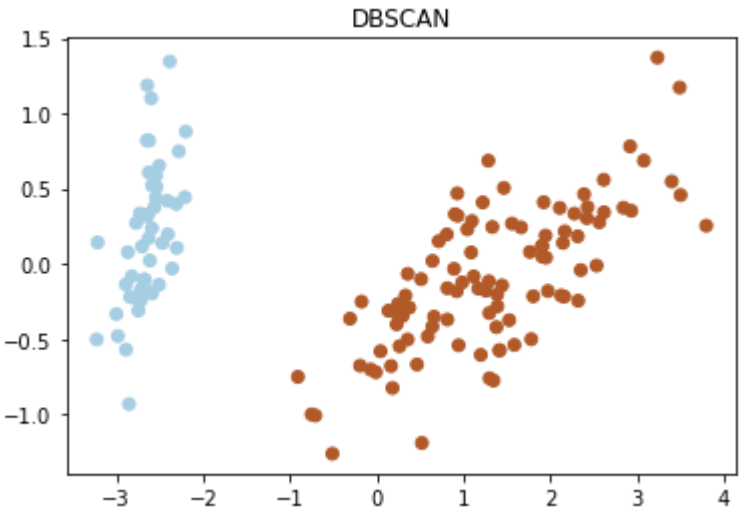
In [19]:
```
dbscan(df1, 0.95, 1)
```



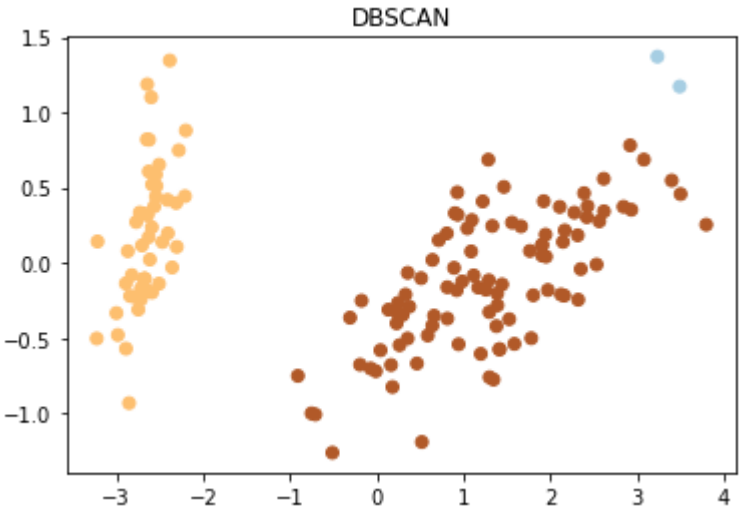
In [20]:
```
dbscan(df1, 0.95, 5)
```



In [21]:
```
dbscan(df1, 0.95, 10)
```



In [22]:
```
dbscan(df1, 0.95, 20)
```



4. Obtain and compare the purity score for all the clustering methods. Sample code snippet is given below.

In [23]:
```
import numpy as np
from sklearn import metrics

def purity_score(y_true, y_pred):
    # compute contingency matrix (also called confusion matrix)
    contingency_matrix = metrics.cluster.contingency_matrix(y_true, y_pred)
    # return purity
    return np.sum(np.amax(contingency_matrix, axis=0)) / np.sum(contingency_matri
```

In [24]:
```
model = AgglomerativeClustering(n_clusters=3, affinity='euclidean', linkage='ward
label_3=model.fit_predict(df)
labels = model.labels_

purity_score(y_true,label_3)
```

Out[24]: 0.9

In [25]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.05, min_samples=10,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[25]: 0.3333333333333333

In [26]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.5, min_samples=10,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[26]: 0.6666666666666666

In [27]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.95, min_samples=10,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[27]: 0.6666666666666666

In [28]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.5, min_samples=1,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[28]: 0.6933333333333334

In [29]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.5, min_samples=5,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[29]: 0.6733333333333333

In [30]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.5, min_samples=10,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[30]: 0.6666666666666666

In [31]:
```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=0.5, min_samples=20,metric='euclidean')
db.fit(df1)
y_pred3 = db.fit_predict(df1)

purity_score(y_true,y_pred3)
```

Out[31]: 0.84

In [ ]: