In [1]:

```
import pandas as pd

ratings = [['john',5,5,2,1],['mary',4,5,3,2],['bob',4,4,4,3],['lisa',2,2,4,5],['lee',1,2,3,4],['harry',2,1,5,5]]
titles = ['user','Jaws','Star Wars','Exorcist','Omen']
movies = pd.DataFrame(ratings,columns=titles)
movies
```

Out[1]:

	user	Jaws	Star Wars	Exorcist	Omen
0	john	5	5	2	1
1	mary	4	5	3	2
2	bob	4	4	4	3
3	lisa	2	2	4	5
4	lee	1	2	3	4
5	harry	2	1	5	5

In [2]:

```
import pandas as pd
from sklearn import cluster

ratings = [['john',5,5,2,1],['mary',4,5,3,2],['bob',4,4,4,3],['lisa',2,2,4,5],['lee',1,2,3,4],['harry',2,1,5,5]]
titles = ['user','Jaws','Star Wars','Exorcist','Omen']
movies = pd.DataFrame(ratings,columns=titles)

data = movies.drop('user',axis=1)
k_means = cluster.KMeans(n_clusters=2,max_iter=50,random_state=1)
k_means.fit(data)
labels = k_means.labels_
pd.DataFrame(labels,index=movies.user,columns=['Cluster ID'])
```

Out[2]:

	Cluster ID
user	
john	0
mary	0
bob	0
lisa	1
lee	1
harry	1

In [3]:

```
import pandas as pd
from sklearn import cluster

ratings = [['john',5,5,2,1],['mary',4,5,3,2],['bob',4,4,4,3],['lisa',2,2,4,5],['lee',1,2,3,4],['harry',2,1,5,5]]
titles = ['user','Jaws','Star Wars','Exorcist','Omen']
movies = pd.DataFrame(ratings,columns=titles)

centroids = k_means.cluster_centers_
pd.DataFrame(centroids,columns=data.columns)
```

Out[3]:

	Jaws	Star Wars	Exorcist	Omen
0	4.333333	4.666667	3.0	2.000000
1	1.666667	1.666667	4.0	4.666667

In [4]:

```
import pandas as pd
from sklearn import cluster
import numpy as np

ratings = [['john',5,5,2,1],['mary',4,5,3,2],['bob',4,4,4,3],['lisa',2,2,4,5],['lee',1,2,3,4],['harry',2,1,5,5]]
titles = ['user','Jaws','Star Wars','Exorcist','Omen']
movies = pd.DataFrame(ratings,columns=titles)

testData = np.array([[4,5,1,2],[3,2,4,4],[2,3,4,1],[3,2,3,3],[5,4,1,4]])
labels = k_means.predict(testData)
labels = labels.reshape(-1,1)
usernames = np.array(['paul','kim','liz','tom','bill']).reshape(-1,1)
cols = movies.columns.tolist()
cols.append('Cluster ID')
newusers = pd.DataFrame(np.concatenate((usernames,testData,labels),axis=1),columns=cols)
newusers
```

Out[4]:

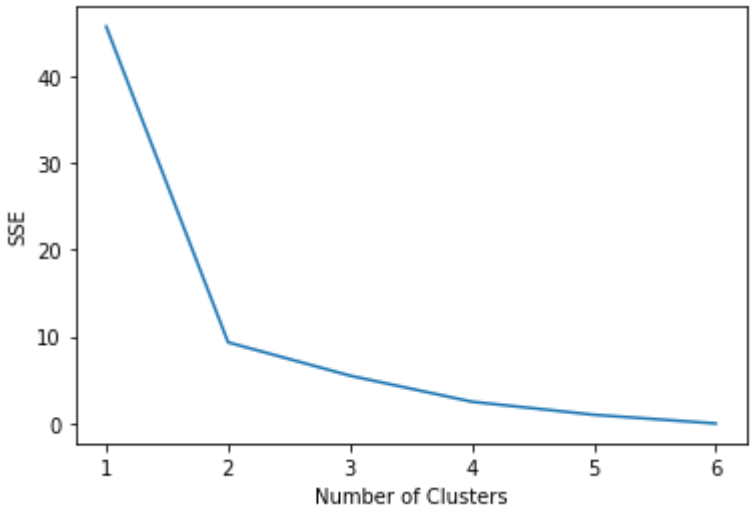
	user	Jaws	Star Wars	Exorcist	Omen	Cluster ID
0	paul	4	5	1	2	0
1	kim	3	2	4	4	1
2	liz	2	3	4	1	0
3	tom	3	2	3	3	1
4	bill	5	4	1	4	0

In [5]:

```
import matplotlib.pyplot as plt
%matplotlib inline

numClusters = [1,2,3,4,5,6]
SSE = []
for k in numClusters:
    k_means = cluster.KMeans(n_clusters=k)
    k_means.fit(data)
    SSE.append(k_means.inertia_)

plt.plot(numClusters,SSE)
plt.xlabel('Number of Clusters')
plt.ylabel('SSE')
```

Out[5]:

```
Text(0, 0.5, 'SSE')
```



In [6]:

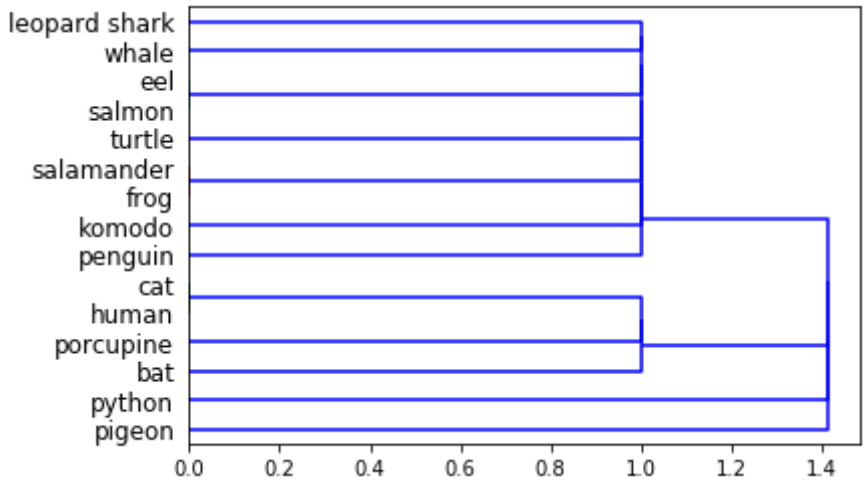
```
import pandas as pd

data = pd.read_csv('6.vertebrate.csv',header='infer')
data
```

Out[6]:

	Name	Warm-blooded	Gives Birth	Aquatic Creature	Aerial Creature	Has Legs	Hibernates	Class
0	human	1	1	0	0	1	0	mammals
1	python	0	0	0	0	0	1	reptiles
2	salmon	0	0	1	0	0	0	fishes
3	whale	1	1	1	0	0	0	mammals
4	frog	0	0	1	0	1	1	amphibians
5	komodo	0	0	0	0	1	0	reptiles
6	bat	1	1	0	1	1	1	mammals
7	pigeon	1	0	0	1	1	0	birds
8	cat	1	1	0	0	1	0	mammals
9	leopard shark	0	1	1	0	0	0	fishes
10	turtle	0	0	1	0	1	0	reptiles
11	penguin	1	0	1	0	1	0	birds
12	porcupine	1	1	0	0	1	1	mammals
13	eel	0	0	1	0	0	0	fishes
14	salamander	0	0	1	0	1	1	amphibians

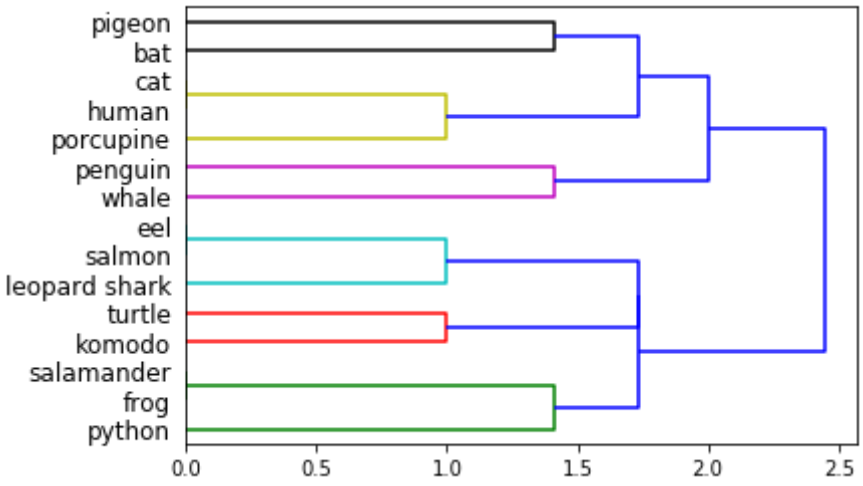
In [11]:

```
import pandas as pd
from scipy.cluster import hierarchy
import matplotlib.pyplot as plt
%matplotlib inline

data = pd.read_csv('6.vertebrate.csv',header='infer')
names = data['Name']
Y = data['Class']
X = data.drop(['Name','Class'],axis=1)
Z = hierarchy.linkage(X.values,'single')
dn = hierarchy.dendrogram(Z,labels=names.tolist(),orientation='right')
```



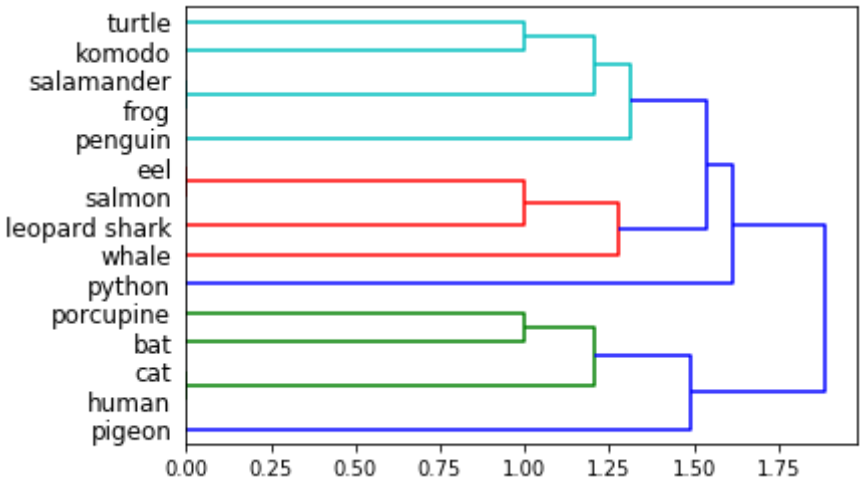
In [12]:

```
import pandas as pd
from scipy.cluster import hierarchy
import matplotlib.pyplot as plt
%matplotlib inline

data = pd.read_csv('6.vertebrate.csv',header='infer')
names = data['Name']
Y = data['Class']
X = data.drop(['Name','Class'],axis=1)
Z = hierarchy.linkage(X.values,'complete')
dn = hierarchy.dendrogram(Z,labels=names.tolist(),orientation='right')
```



In [13]:

```
import pandas as pd
from scipy.cluster import hierarchy
import matplotlib.pyplot as plt
%matplotlib inline

data = pd.read_csv('6.vertebrate.csv',header='infer')
names = data['Name']
Y = data['Class']
X = data.drop(['Name','Class'],axis=1)
Z = hierarchy.linkage(X.values,'average')
dn = hierarchy.dendrogram(Z,labels=names.tolist(),orientation='right')
```

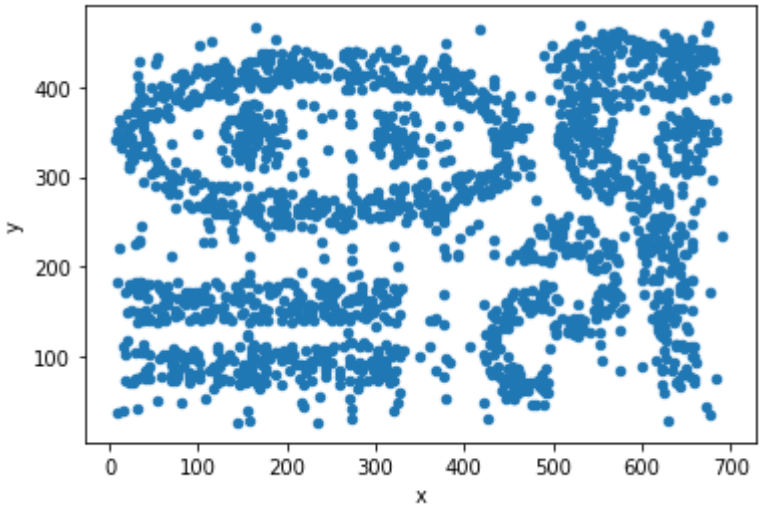


In [15]:

```
import pandas as pd

data = pd.read_csv('8.chameleon.data.csv',delimiter=' ',names=['x','y'])
data.plot.scatter(x='x',y='y')
```

Out[15]:

<matplotlib.axes._subplots.AxesSubplot at 0x2e308798748>

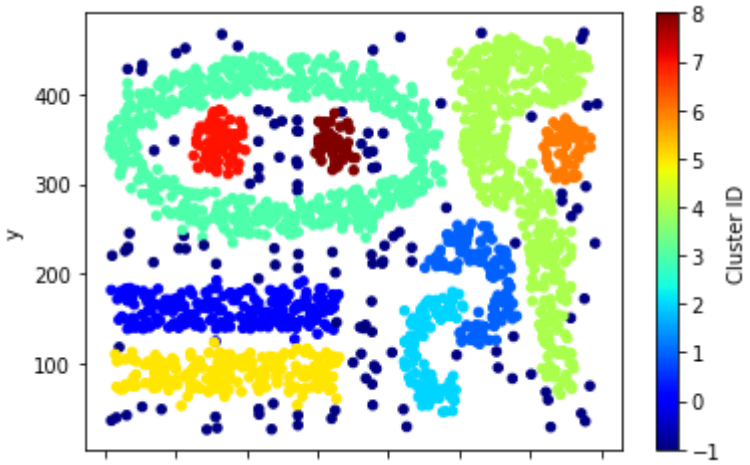


In [16]:

```
import pandas as pd
from sklearn.cluster import DBSCAN

data = pd.read_csv('8.chameleon.data.csv',delimiter=' ',names=['x','y'])
db = DBSCAN(eps=15.5,min_samples=5).fit(data)
core_samples_mask = np.zeros_like(db.labels_,dtype=bool)
core_samples_mask[db.core_sample_indices_] = True
labels = pd.DataFrame(db.labels_,columns=['Cluster ID'])
result = pd.concat((data,labels),axis=1)
result.plot.scatter(x='x',y='y',c='Cluster ID',colormap='jet')
```

Out[16]:

<matplotlib.axes._subplots.AxesSubplot at 0x2e3087e96c8>

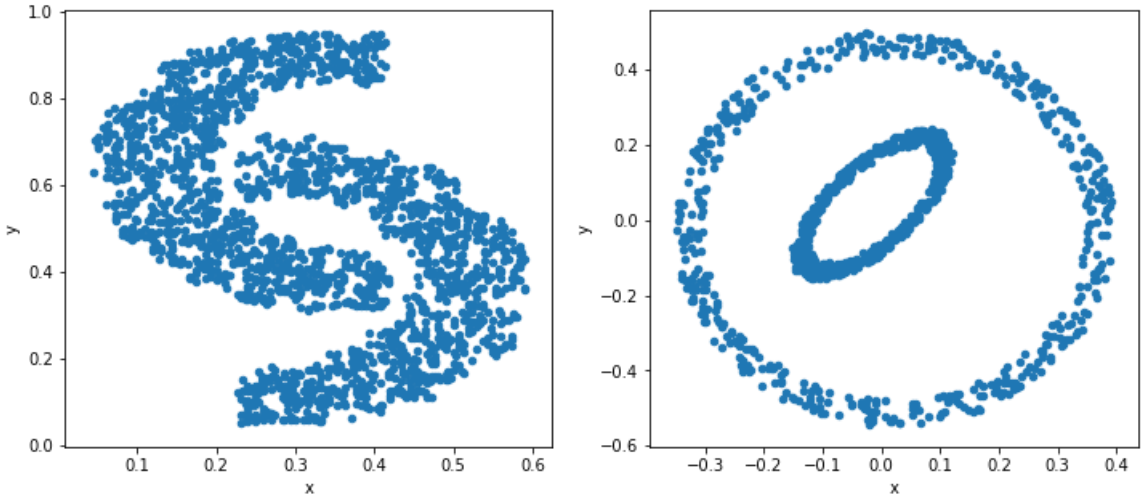


In [17]:

```
import pandas as pd

data1 = pd.read_csv('8.2d_data.csv',delimiter=' ',names=['x','y'])
data2 = pd.read_csv('8.elliptical.csv',delimiter=' ',names=['x','y'])

fig,(ax1,ax2) = plt.subplots(nrows=1,ncols=2,figsize=(12,5))
data1.plot.scatter(x='x',y='y',ax=ax1)
data2.plot.scatter(x='x',y='y',ax=ax2)
```

Out[17]:

<matplotlib.axes._subplots.AxesSubplot at 0x2e3086b6448>

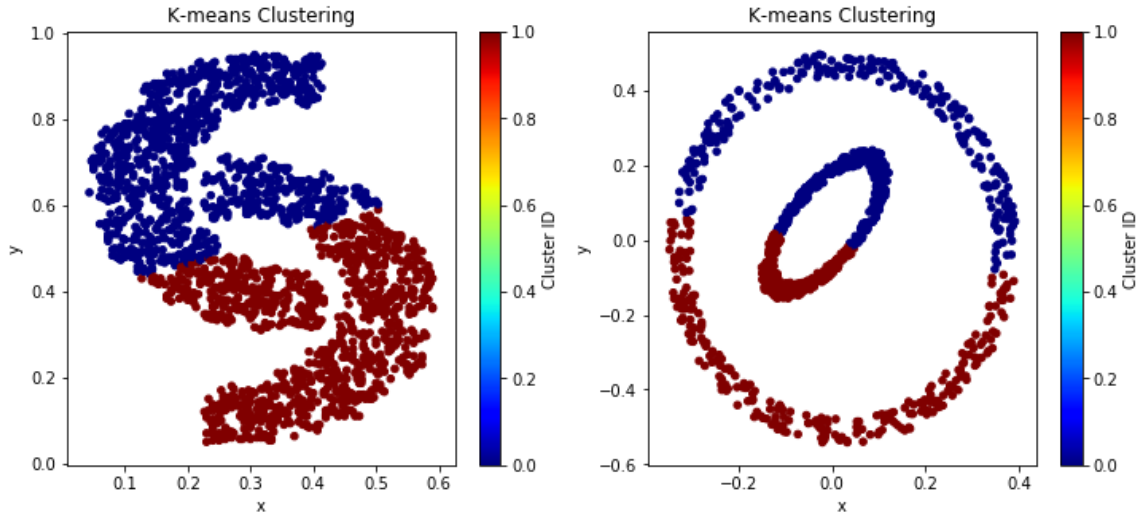


In [18]:

```
import pandas as pd
from sklearn import cluster

data1 = pd.read_csv('8.2d_data.csv',delimiter=' ',names=['x','y'])
data2 = pd.read_csv('8.elliptical.csv',delimiter=' ',names=['x','y'])

k_means = cluster.KMeans(n_clusters=2,max_iter=50,random_state=1)
k_means.fit(data1)
labels1 = pd.DataFrame(k_means.labels_,columns=['Cluster ID'])
result1 = pd.concat((data1,labels1),axis=1)

k_means2 = cluster.KMeans(n_clusters=2,max_iter=50,random_state=1)
k_means2.fit(data2)
labels2 = pd.DataFrame(k_means2.labels_,columns=['Cluster ID'])
result2 = pd.concat((data2,labels2),axis=1)

fig,(ax1,ax2) = plt.subplots(nrows=1,ncols=2,figsize=(12,5))
result1.plot.scatter(x='x',y='y',c='Cluster ID',colormap='jet',ax=ax1)
ax1.set_title('K-means Clustering')
result2.plot.scatter(x='x',y='y',c='Cluster ID',colormap='jet',ax=ax2)
ax2.set_title('K-means Clustering')
```

Out[18]:

```
Text(0.5, 1.0, 'K-means Clustering')
```



In [ ]:

In [ ]: