PACT 4.2 - K-Means Clustering & Louvain Community Detection

For our PACT project, we planned to implement an unsupervised machine learning in order to automatically classify our users based on 3 criteria : total number of parties (party_nb), interactions with other user (social_score), and the alcohol intake(alcohol_unit).

Recap from last meeting with our expert :

1. Try Louvain to classify the users by their interactions.
2. Try K-Means to classify the users by certain criteria.

```
This notebook contains 2 parts : Clustering K-Means & Louvain Community Detection
```

K-Means Explanation :

1. First of all, I have generated a CSV file that contains 200 users (they are all random value as we couldn't find time to hold a party :( ).
2. I packed the data into a panda dataframe.
3. Then, I decide the number of clusters based on the "ELBOW".
4. Finally, I use scikit-learn K-Means library to for clustering.

Louvain Community Detection Explanation :

1. Firstly, I generate a 2-dimensionnal matrix to represent the interaction.
2. Then, I draw a graph based on the matrix.
3. Finally, I calculate the partition.

K-Means

In [16]:
```
%matplotlib inline

import pandas as pd
import matplotlib.pyplot as plt
from sklearn import preprocessing
from sklearn.cluster import KMeans
```

Read the CSV

This will be replace by the Android Application Database during integration.

In [17]:
```
dataset1 = pd.read_csv('./pact.csv', delimiter=';',names=['party_nb', 'social_score', 'alcohol_unit'])
dataset1.head()
```

Out[17]:

		party_nb	social_score	alcohol_unit
1	Joelng	30	0,123893039	2
2	Bernard	56	0,707285916	12
3	Thomas	41	0,735162233	25
4	Petit	11	0,443041305	8
5	Robert	20	0,481910074	25

Show the type and shape of dataset

We have 200 users and 3 features in the dataset. The datatype is a Panda DataFrame.

In [18]:
```
print(dataset1.shape)
type(dataset1)
```

```
(200, 3)
```

Out[18]:
```
pandas.core.frame.DataFrame
```

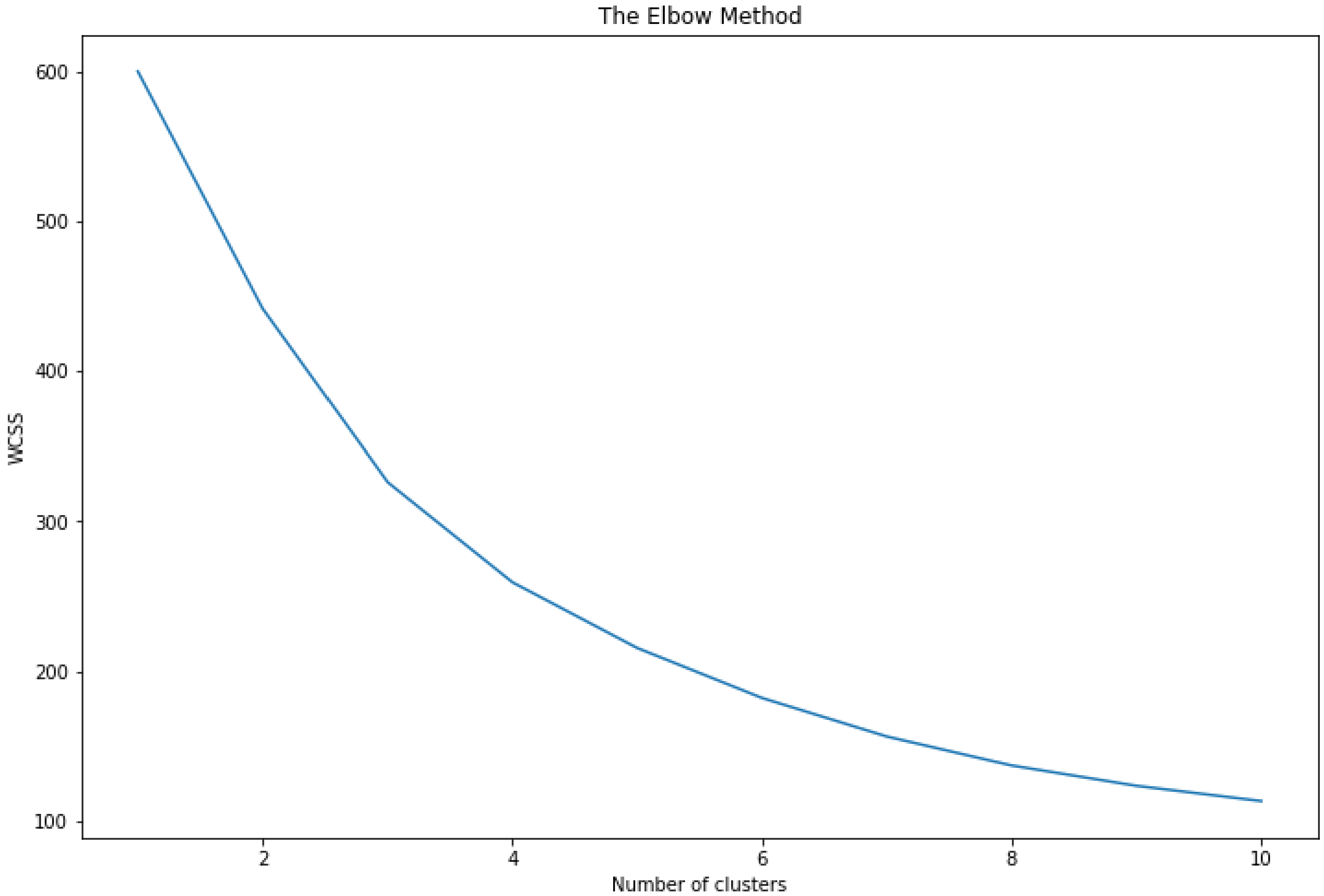
In [19]:
```
number = preprocessing.LabelEncoder()
dataset1['party_nb'] = number.fit_transform(dataset1['party_nb'])
dataset1=dataset1.fillna(-999) # fill holes with default value
#print(dataset1.describe(include='all'))
dataset1['social_score'] = number.fit_transform(dataset1['social_score'])
dataset1=dataset1.fillna(-999) # fill holes with default value
#print(dataset1.describe(include='all'))
dataset1['alcohol_unit'] = number.fit_transform(dataset1['alcohol_unit'])
dataset1=dataset1.fillna(-999) # fill holes with default value
#print(dataset1.describe(include='all'))
dataset1.describe()

dataset1_standardized = preprocessing.scale(dataset1)
dataset1_standardized = pd.DataFrame(dataset1_standardized)
```

Find the appropriate cluster number by the elbow method

We see that 2 or 3 is the optimal number of clusters.

In [20]:
```
# find the appropriate cluster number
plt.figure(figsize=(12, 8))
wcss = [] #summation of the each clusters distance between that specific clusters each points against the clust
for i in range(1, 11):
    kmeans = KMeans(n_clusters = i)
    kmeans.fit(dataset1_standardized)
    wcss.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss)
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```



Fitting K-Means to the dataset

In [21]:
```
kmeans = KMeans(n_clusters = 4)
kmeans.fit(dataset1_standardized)
kmeans.predict(dataset1_standardized)
labels = kmeans.labels_
print(len(labels))
dataset1['Class'] = labels
dataset1
```

```
200
```

Out[21]:

		party_nb	social_score	alcohol_unit	Class
1	JoeIng	29	24	2	1
2	Bernard	55	138	12	3
3	Thomas	40	141	25	3
4	Petit	11	95	8	0
5	Robert	19	102	25	2
...	...	...	...	...	...
196	Lamy	11	182	17	0
197	Delaunay	18	84	0	1
198	Pasquier	23	172	21	3
199	Carlier	45	66	11	1
200	Martin	44	169	3	3

200 rows × 4 columns

Louvain Community Detection

In [22]:
```
import networkx as nx
import matplotlib.pyplot as plt
import community
import numpy as np
```

Generate my data (Friends) in matrix form

We generate 10 users to test and randomly set the value of matrix (1=friend ; 0=not friend)

In [23]:
```
matrix = np.zeros( (10, 10) )
print("Size of matrix : ", len(matrix))

for i in range (len(matrix)):
     for j in range(len(matrix)):
        matrix[i, i] = 0 #can't be friend with yourself
        matrix[i, j] = np.random.randint(low=0, high=2) #randomly be friends with someone else

print(matrix)
```

```
Size of matrix :  10
[[0. 0. 0. 0. 0. 0. 1. 0. 1. 0.]
 [1. 0. 0. 1. 1. 0. 1. 1. 0. 0.]
 [0. 1. 0. 0. 0. 0. 1. 0. 1. 0.]
 [1. 1. 0. 0. 1. 1. 0. 0. 1. 1.]
 [1. 0. 0. 1. 0. 0. 1. 1. 0. 0.]
 [0. 0. 1. 1. 0. 0. 0. 0. 0. 0.]
 [1. 1. 0. 0. 1. 1. 0. 1. 1. 0.]
 [1. 1. 0. 1. 0. 0. 0. 0. 1. 1.]
 [1. 1. 0. 0. 1. 1. 1. 0. 0. 1.]
 [0. 0. 0. 1. 1. 1. 1. 1. 1. 0.]]
```

Draw the graph from the matrix

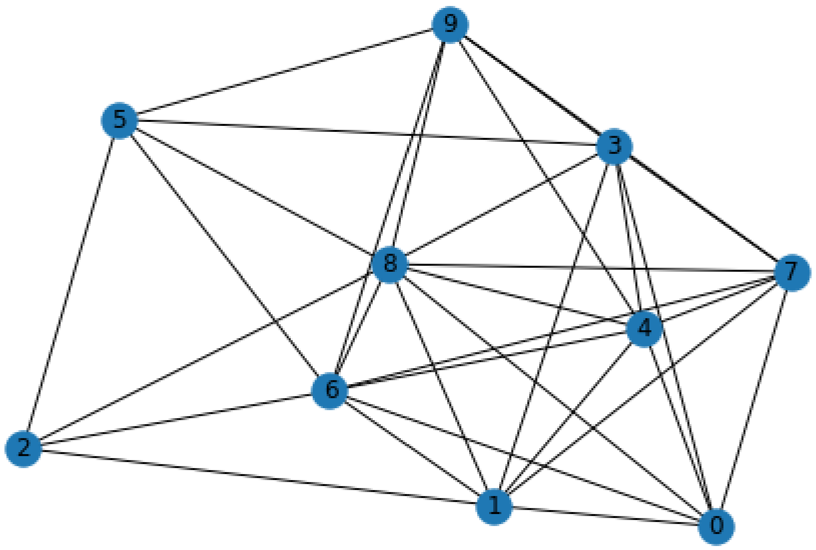
In [26]:
```
graphPACT = nx.Graph()

for i in range (len(matrix)):
     for j in range(len(matrix)):
            if(matrix[i,j] == 1):
                graphPACT.add_edges_from([(i, j)])

print("Number of nodes : ",graphPACT.number_of_nodes())

nx.draw(graphPACT, with_labels=True)
plt.show;
```

```
Number of nodes :  10
```



Compute the best partition

In [25]:
```
partitionPACT = community.best_partition(graphPACT)

for k in partitionPACT :
    print("Community of ",k ," : ", partitionPACT[k])

#print(partitionPACT)
```

```
Community of  0  :  0
Community of  6  :  0
Community of  8  :  1
Community of  1  :  0
Community of  3  :  1
Community of  4  :  0
Community of  7  :  0
Community of  2  :  1
Community of  5  :  1
Community of  9  :  1
```