

Round 3

Data Set - Facebook network

Dataset Description :

The facebook network contains 4039 users. An edge exists between 2 users if they are friend of each other. This is an undirected graph with a total of 88234 edges.

Finding Random Sample

Since the original network is huge , we used a random sample in order to get the inferences.

In [8]:

```
#finding random sample
import os
import random

filename = 'facebook.txt'

result = []
f = open("facebook1.txt", "a")

with open(filename) as fh:
    data = fh.readlines()
    for line in data:
        if line:
            words = line.split()
            result.append(words)

sample = random.sample(result, 5000)

for item in sample:
    f.write(item[0] + " " + item[1] + "\n")
```

Now using the above random sample , we will read the graph G from the list of edges ('facebook1.txt') and find the general information about the graph.

In [1]:

```
import networkx as nx

#reading graph from list of edges
G=nx.read_edgelist('facebook1.txt',nodetype=int,create_using=nx.Graph())

print(" ")

#general information about the graph
print (nx.info(G))
```

```
Name:
Type: Graph
Number of nodes: 3127
Number of edges: 6812
Average degree: 4.3569
```

Basic Information about graph:

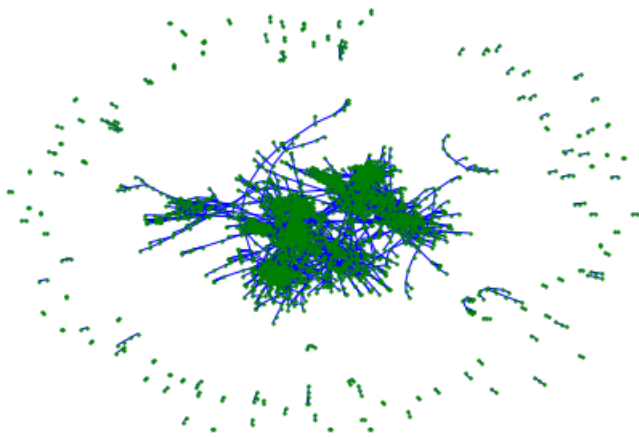
From here , we can see that the graph generated has 3127 nodes and 6812 edges. It is a directed graph and average degree is 4.3569.

Graph Representation

In [10]:

```
import matplotlib.pyplot as plt

# drawing graph
nx.draw(G, pos=None, node_color='g', edge_color='b', node_size=2)
plt.show()
#print (nx.is_connected(G))
```



In the graph , nodes are represented by green colour and directed edges are represented by blue colour.

Community detection

There are a variety of community detection algorithms. When detecting communities, we are interested in detecting communities with either (1) specific members or (2) specific forms of communities. We denote the former as member-based community detection and the latter as group-based community detection.

Hierarchial Clustering

Hierarchical clustering generates community hierarchies. Initially, n nodes are considered as either 1 or n communities in hierarchical clustering. These communities are gradually merged or split (agglomerative or divisive hierarchical clustering algorithms), depending on the type of algorithm, until the desired number of communities are reached.

We have used Girvan-Newman Algorithm here which is a divisive clustering algorithm. Since we have total 3124 nodes in our sampled graph , we have taken k=200 , i.e., we want to have 200 clusters in total.

In []:

```
##comp = nx.algorithms.community centrality.girvan_newman(G)
import itertools
k = 200
#q=[]
comp = nx.algorithms.community centrality.girvan_newman(G)
limited = itertools.takewhile(lambda c: len(c) <= k, comp)
for communities in limited:
    print(tuple(sorted(c) for c in communities))
# print "\n"
```

```
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This shows set of all clusters starting from 1 cluster till 200 clusters are made

Clique Percolation Method (CPM)

Given parameter k , the method starts by finding all cliques of size k . Then a graph is generated (clique graph) where all cliques are represented as nodes, and cliques that share $k - 1$ vertices are connected via edges. Communities are then found by reporting the connected components of this graph.

In [3]:

```
#fixing k=4
from networkx.algorithms.community import k_clique_communities
c = list(k_clique_communities(G, 3))

#printing all the communities
print c
```

```
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Hered,we can observe that all cliques of size $k = 3$ have been identified and cliques that share $k-1 = 2$ nodes are connected. All the obtained communities are given above.