Assignment – 5: Drawing Graphs

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Problem:

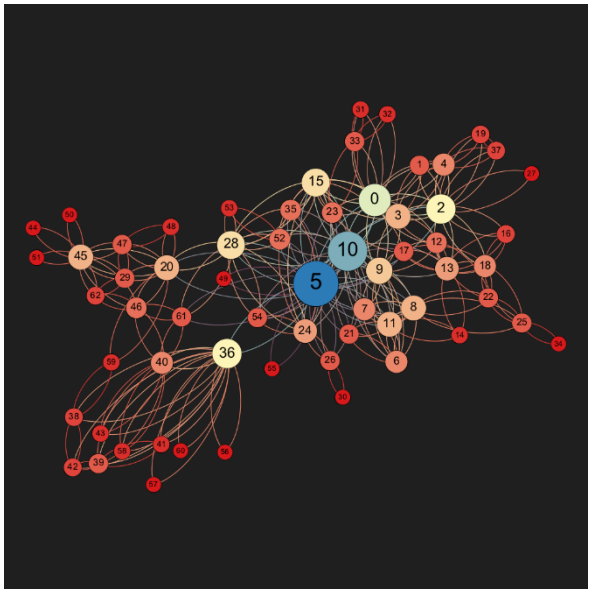
Tools Used in this project for Drawing Graphs are **Gephi** and **Cytoscape**

Datasets taken are

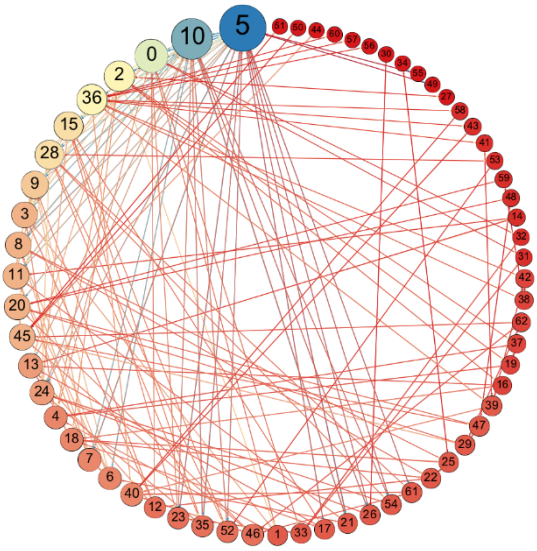
1. **terrornet_edgelist**
2. **ego_Facebook –** (from snap site) [Nodes: 1034, Edges: 26749]
3. **randomly Generated** graph (small world) [Nodes: 1000, avg. out degree: 5, rewiring probability: 0.12]

Terrornet_edgelist:

Gephi:



Terror Graph with no specific layout



Terror Graph with circular Layout sort by Degree

Inferences:

From the graph we can see that the graph has high Avg. clustering coefficient with Node 5 having the highest clustering coefficient. We also computed the avg. clustering coefficient and observed a relatively higher graph clustering coefficient.

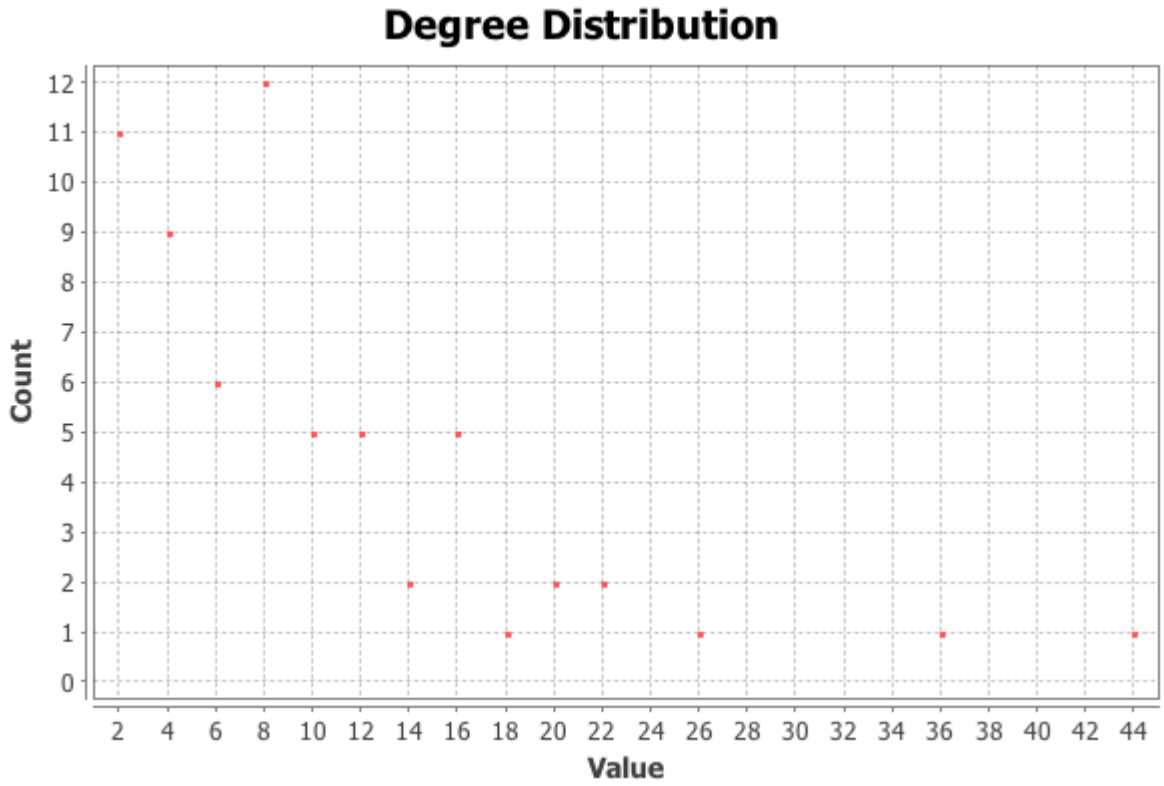
Clustering Coefficient:

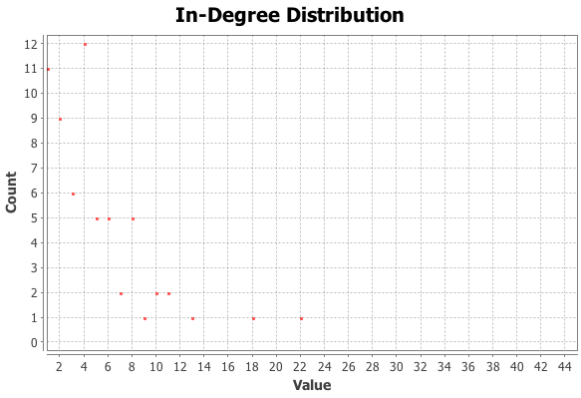
Average Clustering Coefficient: 0.478

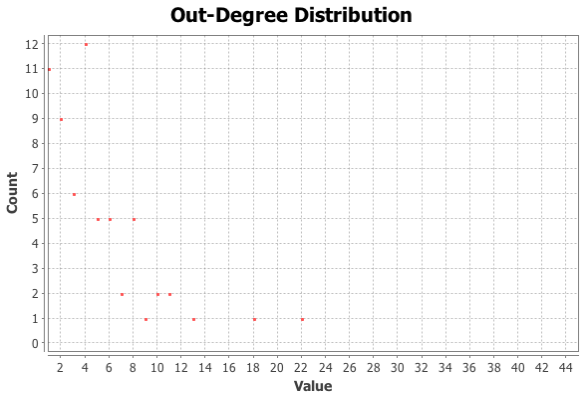
The Average Clustering Coefficient is the mean value of individual coefficients.

Degree:

Average Degree: 4.889



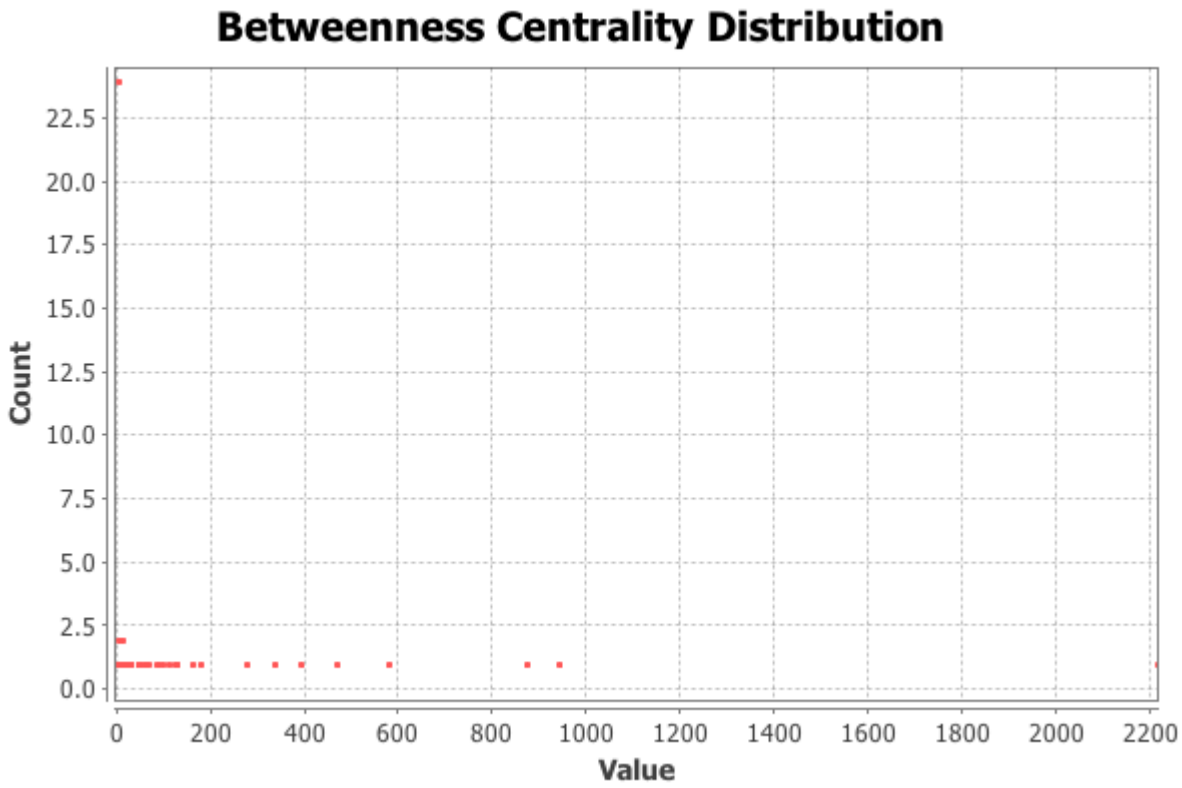


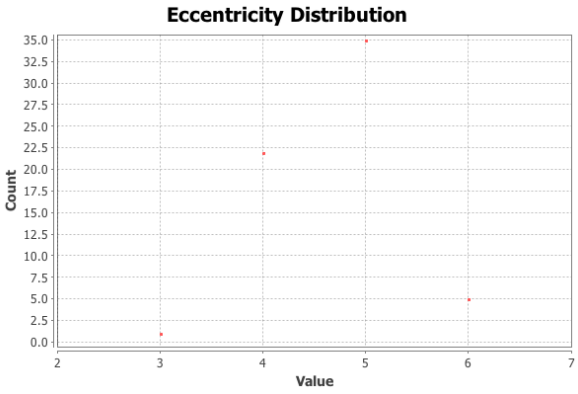


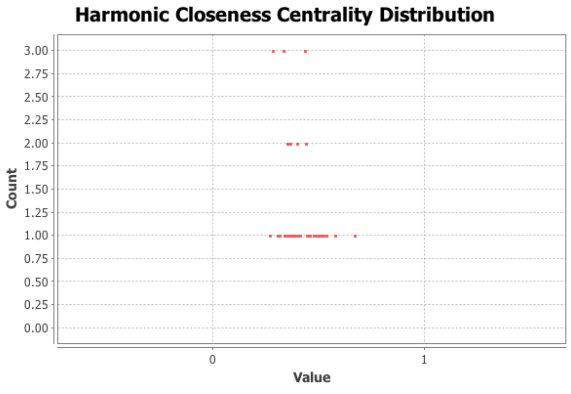
Inferences:

There are only a few nodes with high-degree. This can be observed in both the graph plot and the degree-distribution plots. Also we can observe that low-degree nodes have less interconnectivity among themselves, with more connectivity to the higher degree nodes, thus explaining high degree nodes act as bridging nodes and have more betweennes centrality.

Graph Distance:
Diameter: 6
Average Path length: 2.959037378392217







Inferences:
Nodes with high-degree had higher betweenness centrality than the rest. This is also shown in the graph plot above as there are only a few betweenness values with higher count.

Cytoscape:

We found that this tool can work with larger graphs much easily, although visualization of larger graphs (picture quality, layouts based on metrics) was better with the Gephi tool.

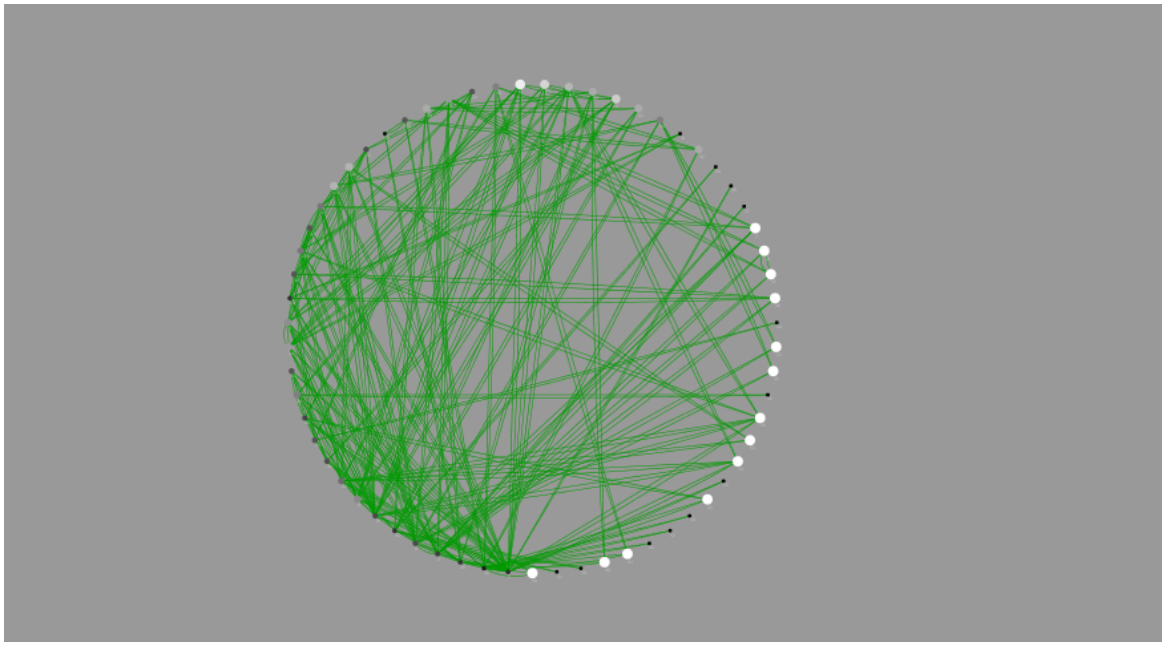
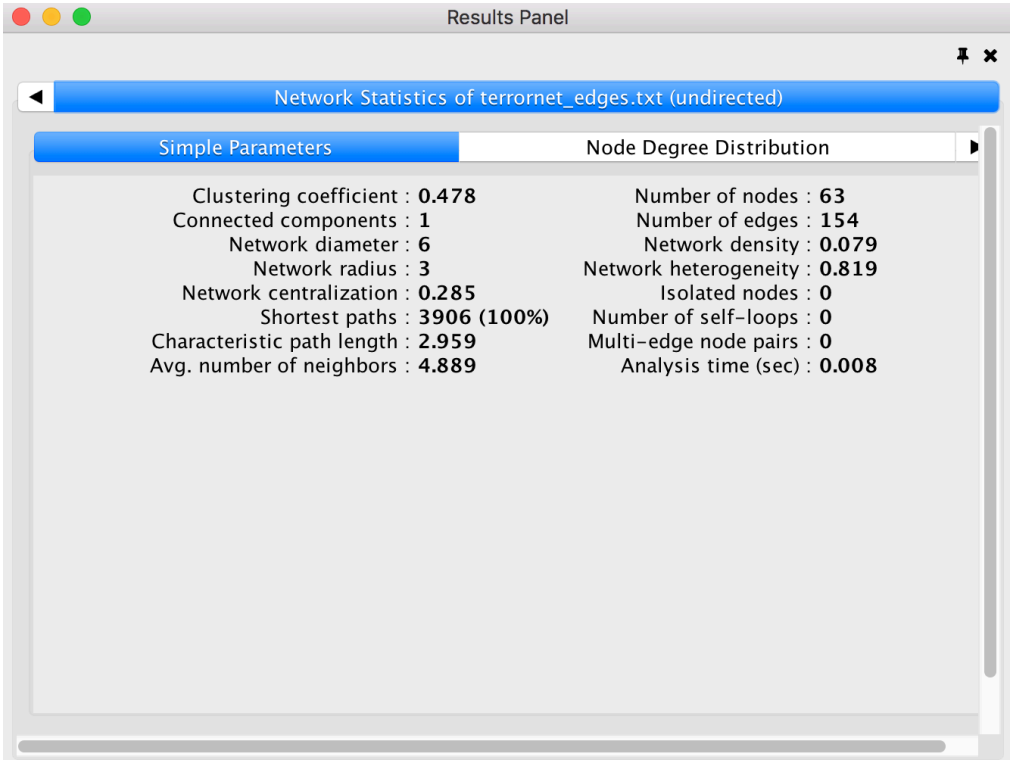
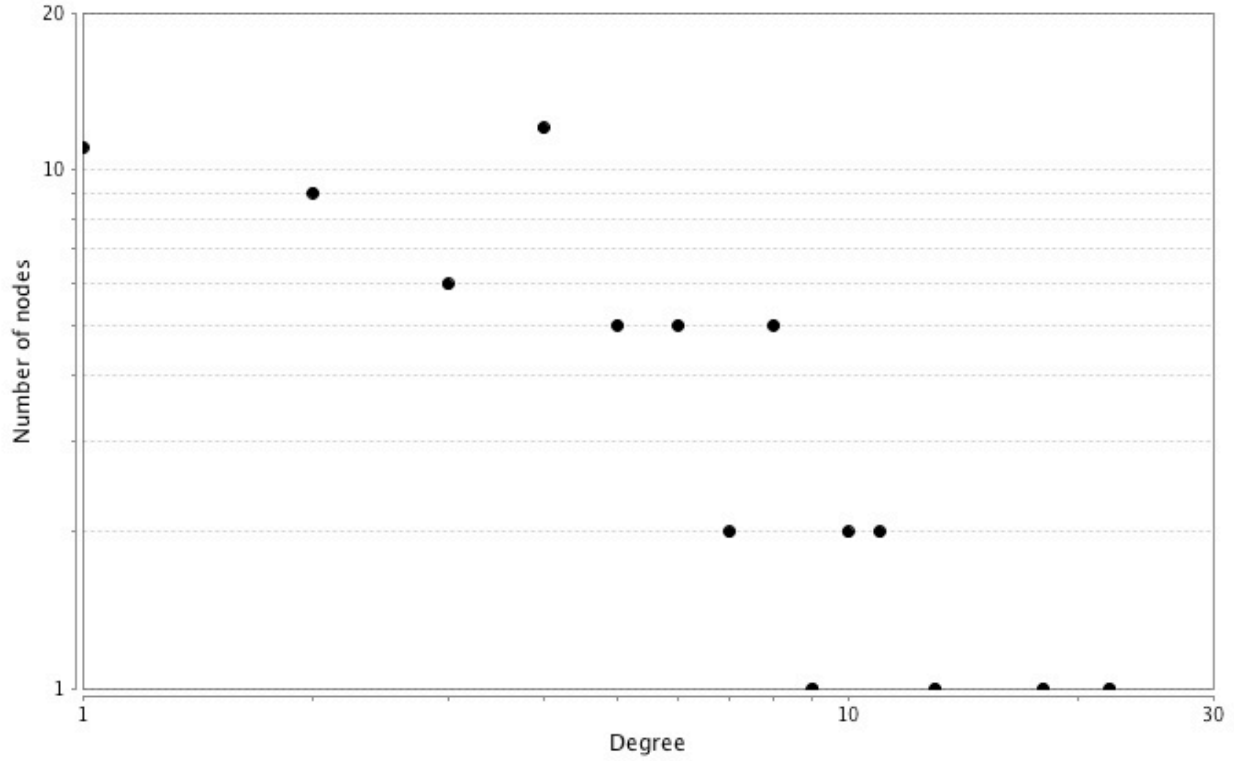


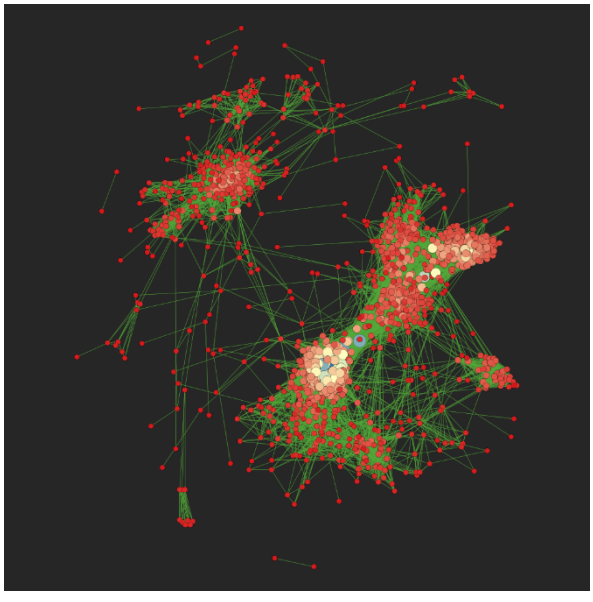
Fig. Terrornet Visualized on a circualr layout with node size ordered on clustering coefficient



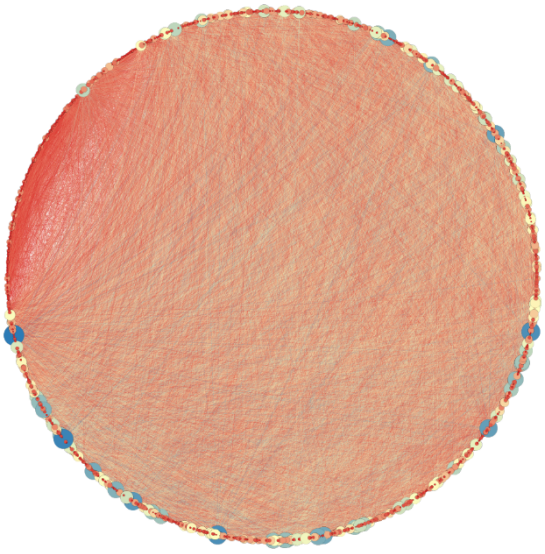


Plots were different on scale in Cytoscape than Gephi. Cytoscape tool provided a better scale plot to better identify/interpret the data from the plots.

Ego_Facebook:
Gephi:



TerrorGraph with no specific layout



Terror Graph with circular Layout sort by Degree

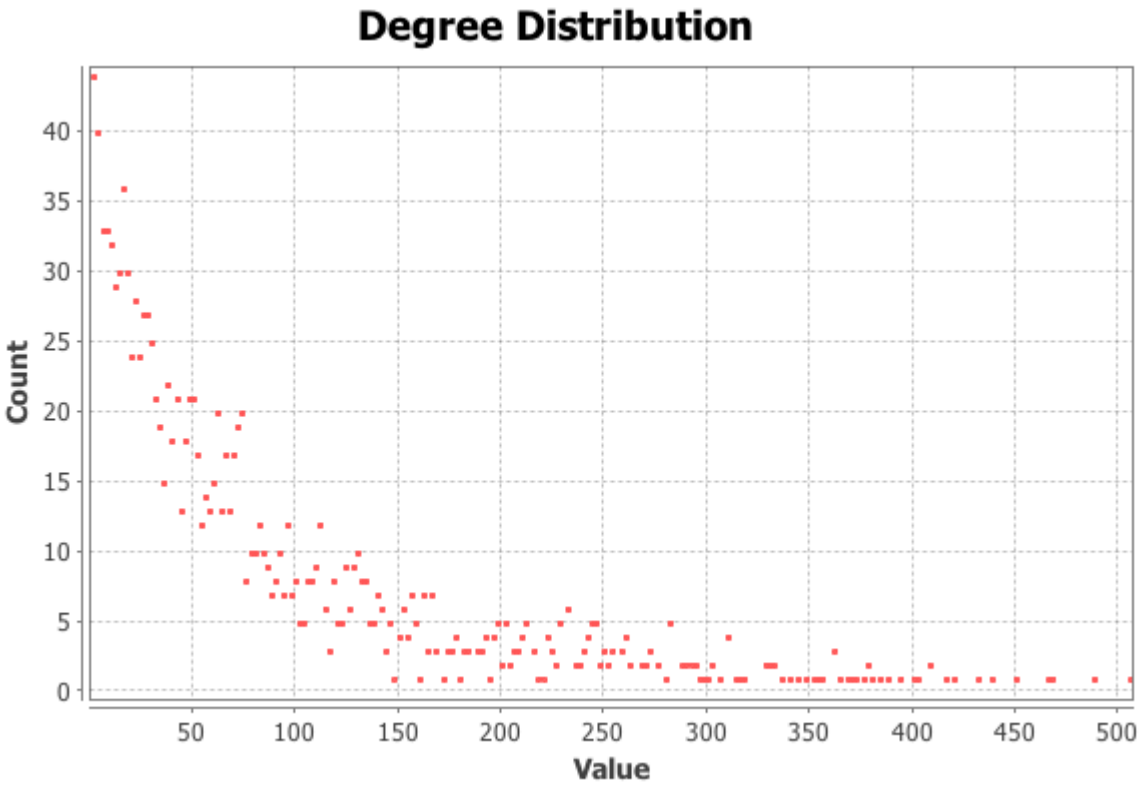
Clustering Coefficient:

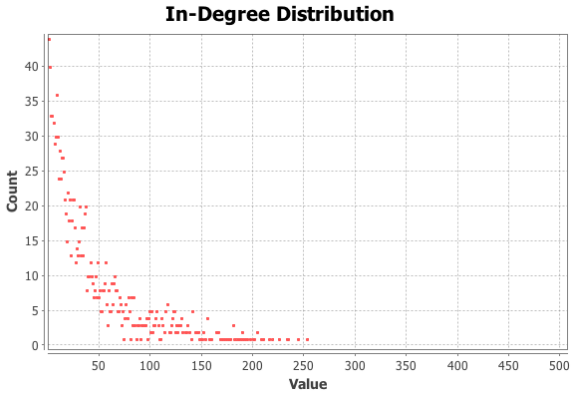
Average Clustering Coefficient: 0.522

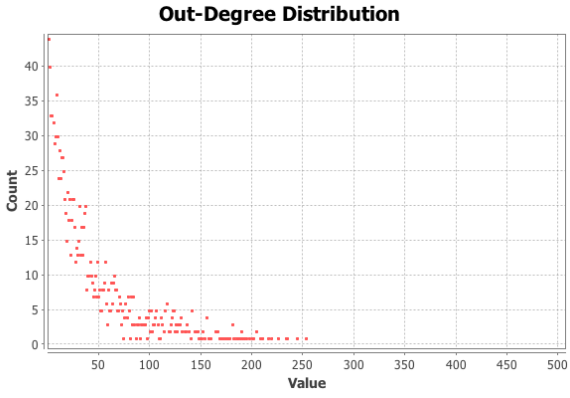
The Average Clustering Coefficient is the mean value of individual coefficients.

Degree:

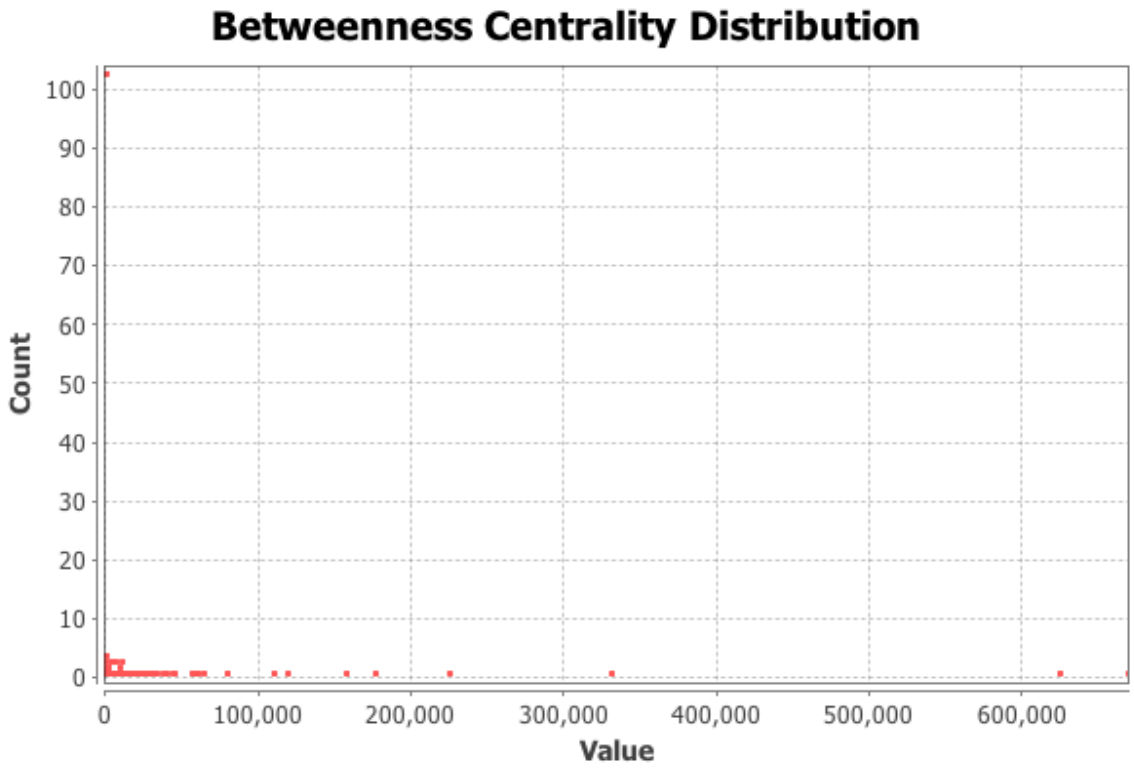
Average Degree: 42.884

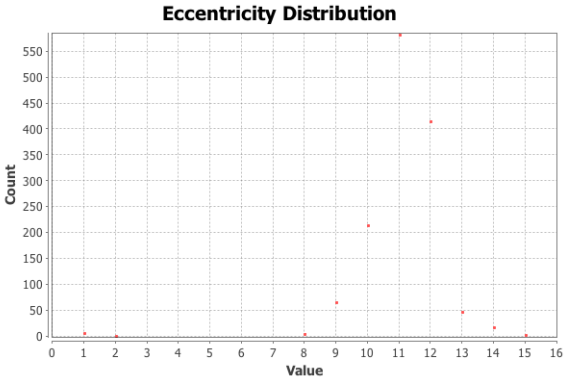


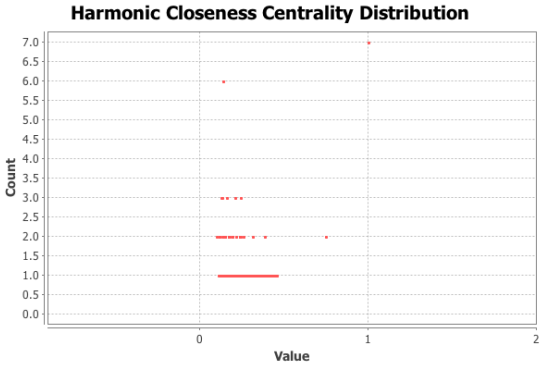




Graph Distance:
Diameter: 15
Radius: 1
Average Path length: 4.437037932025392

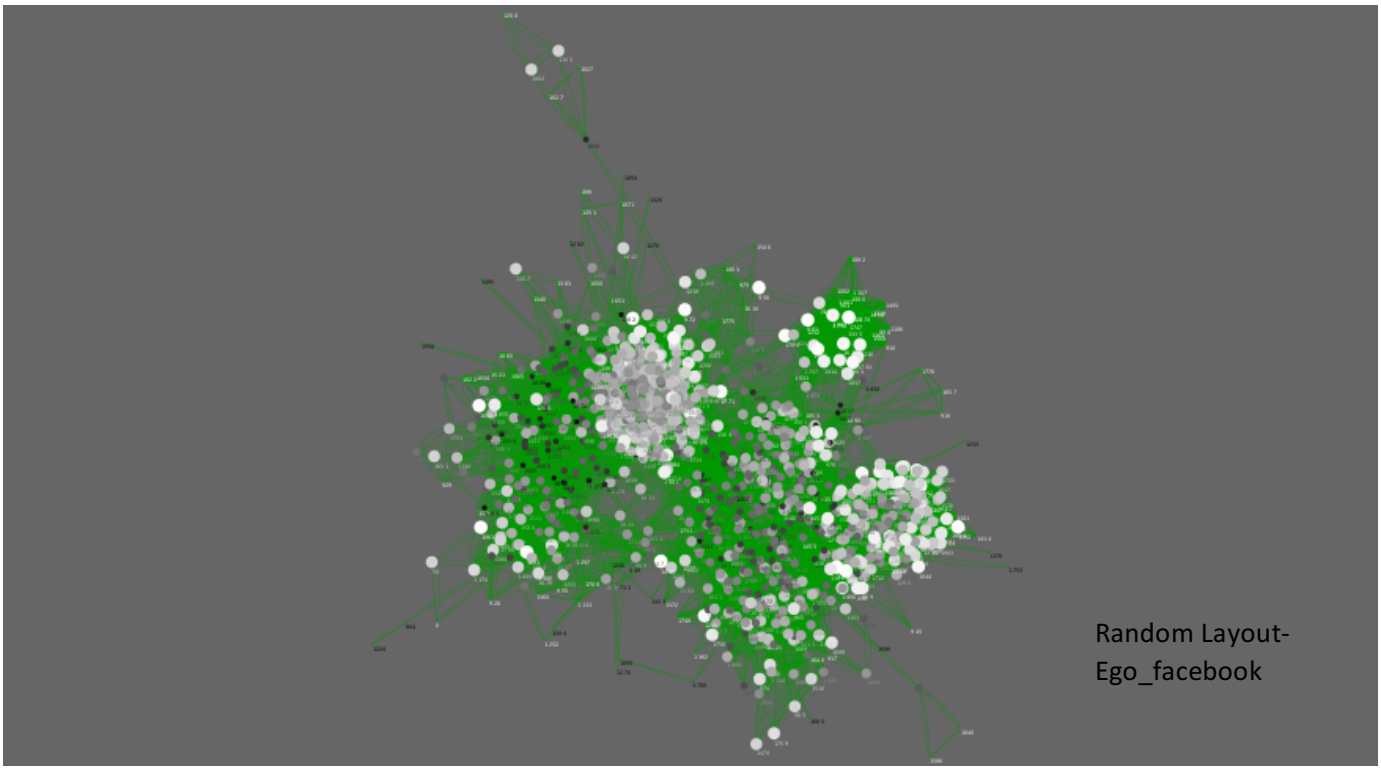




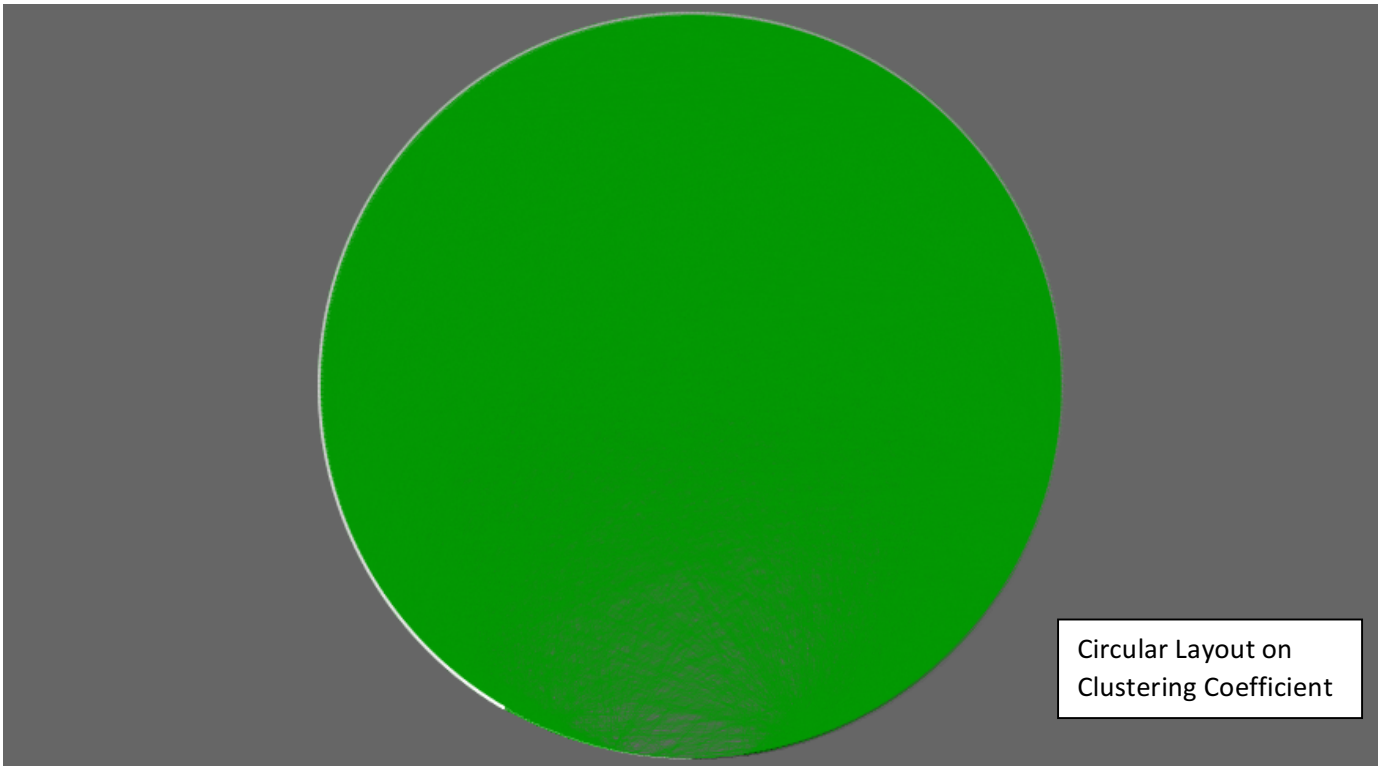


Connected Component:
Number of Weakly Connected Components: 5
Number of Stronlgy Connected Components: 5

Cytoscape:



Random Layout-
Ego_facebook



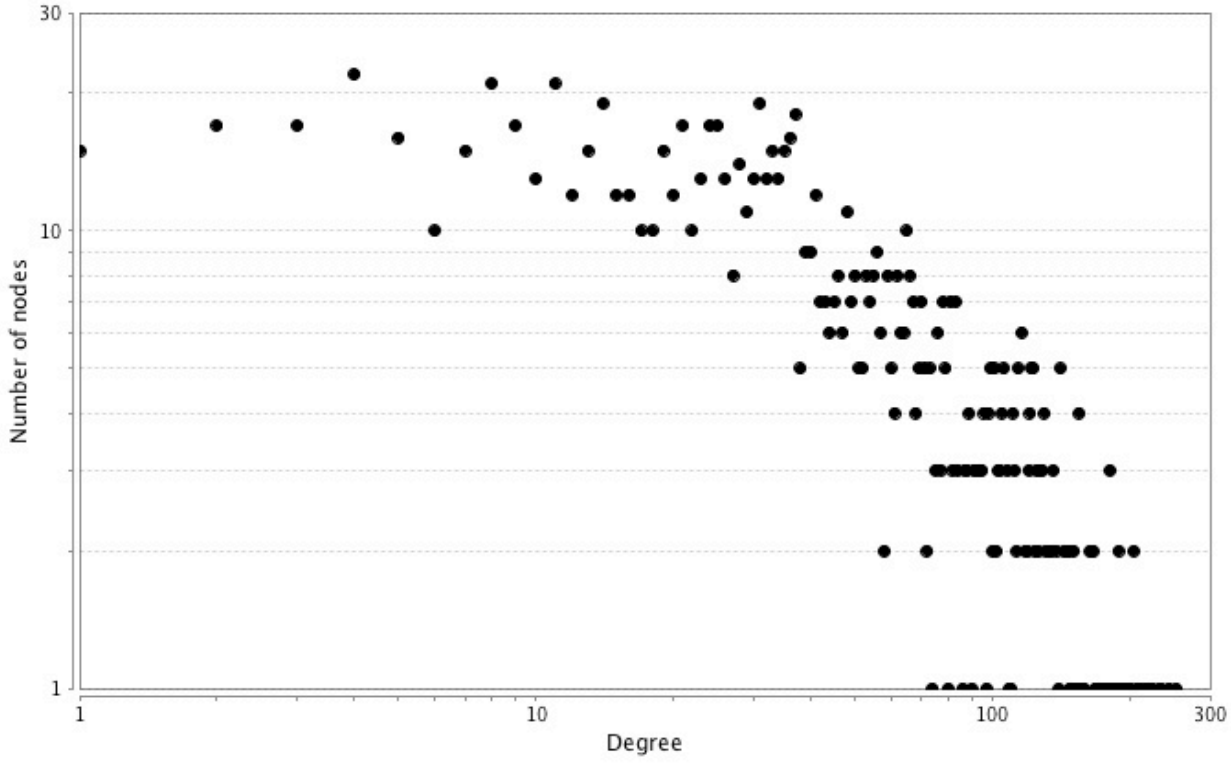
Circular Layout on
Clustering Coefficient

Results Panel

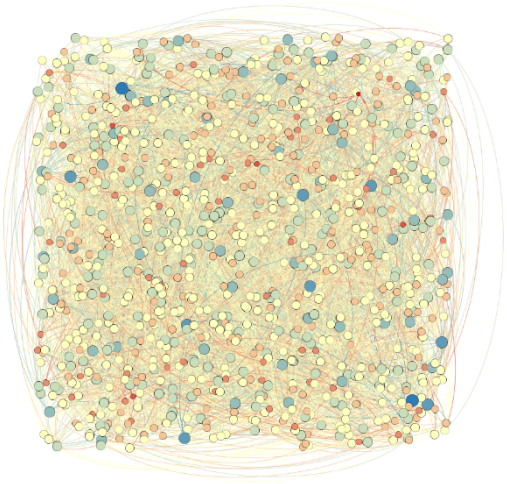
Network Statistics of 107.edges (undirected)

Simple Parameters | Node Degree Distribution

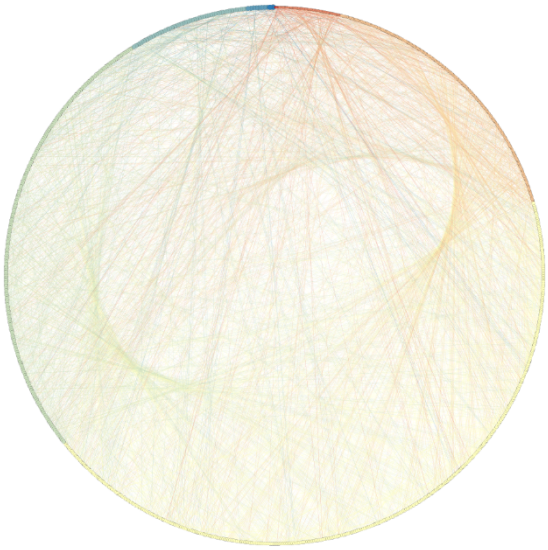
Clustering coefficient :	**0.526**	Number of nodes :	**1034**
Connected components :	**1**	Number of edges :	**26749**
Network diameter :	**9**	Network density :	**0.050**
Network radius :	**5**	Network heterogeneity :	**0.908**
Network centralization :	**0.195**	Isolated nodes :	**0**
Shortest paths :	**1068122 (100%)**	Number of self-loops :	**0**
Characteristic path length :	**2.952**	Multi-edge node pairs :	**0**
Avg. number of neighbors :	**51.739**	Analysis time (sec) :	**1.127**



rndGraph:
Gephi:

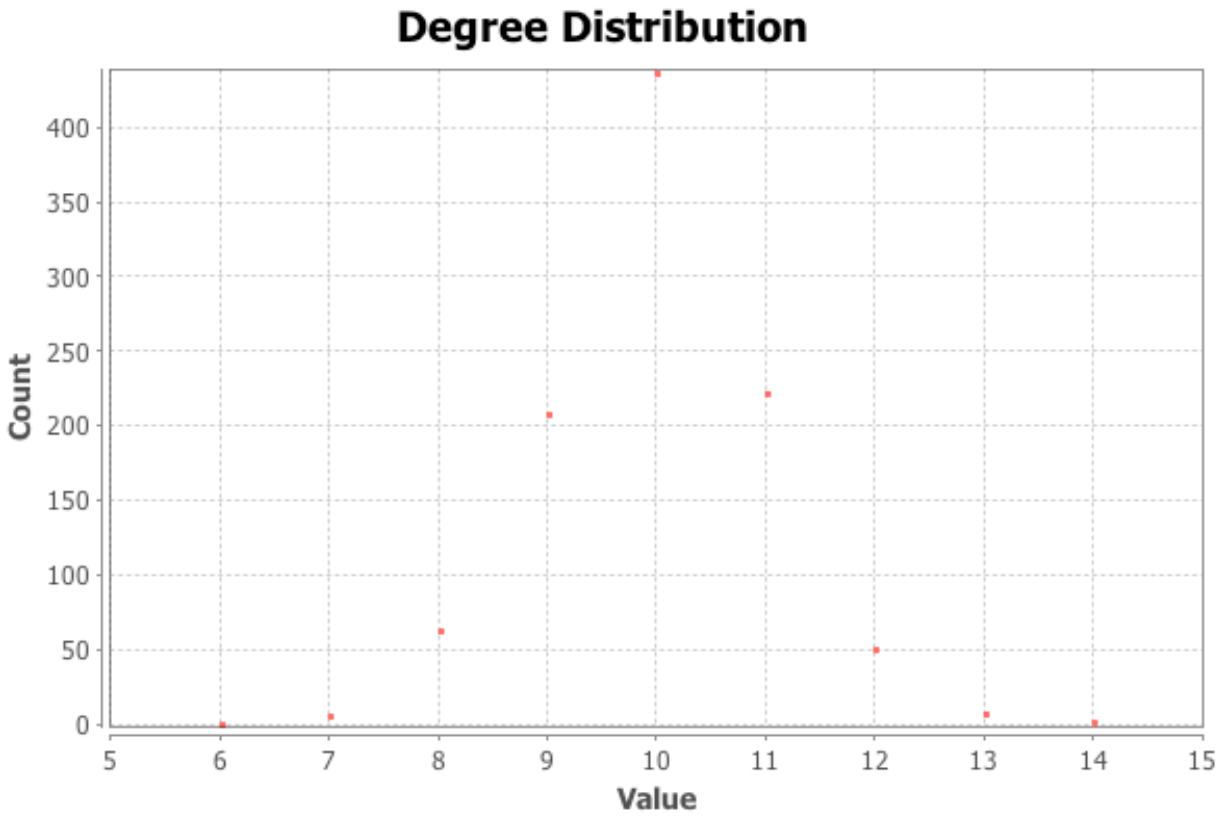


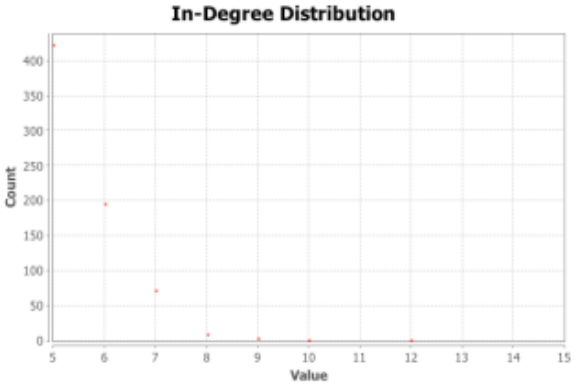
TerrorGraph with no specific layout

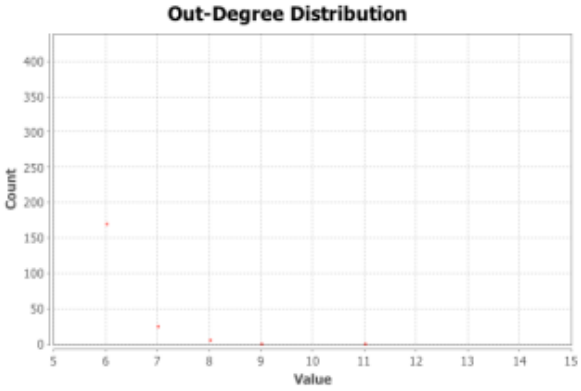


Terror Graph with circular Layout sort by Degree

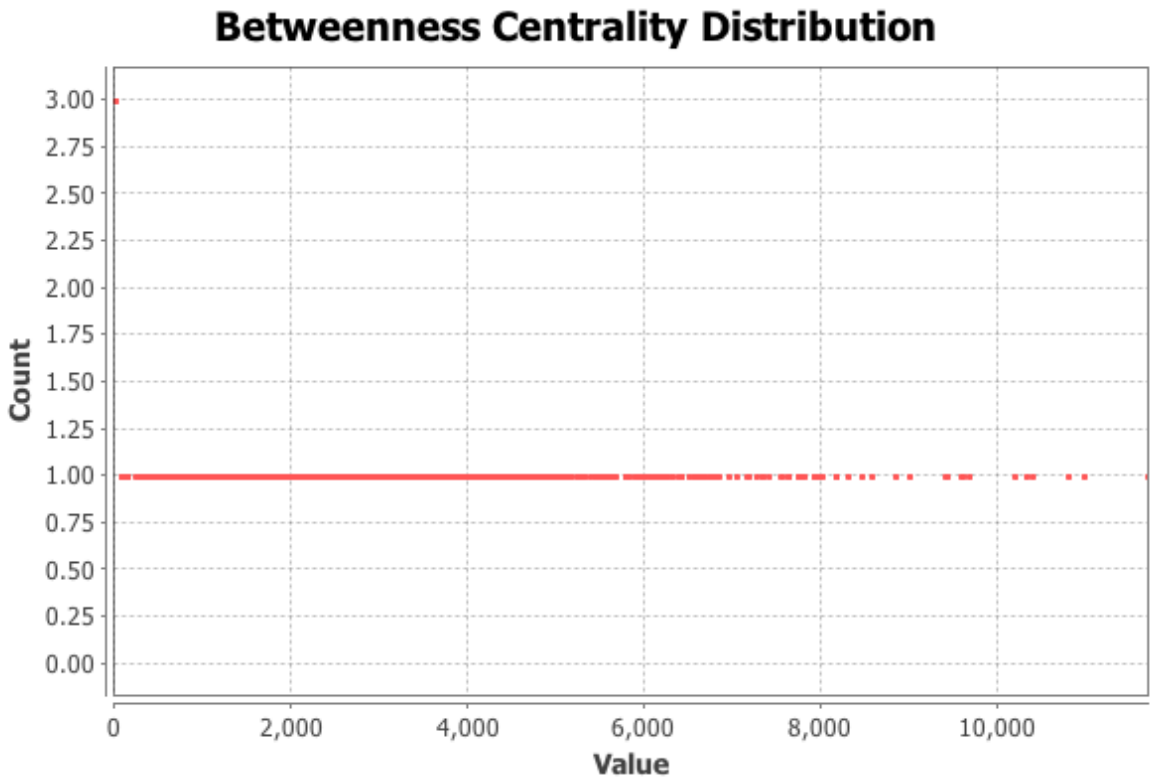
Clustering Coefficient:
Average Clustering Coefficient: 0.234
The Average Clustering Coefficient is the mean value of individual coefficients.
Degree:
Average Degree: 5.000

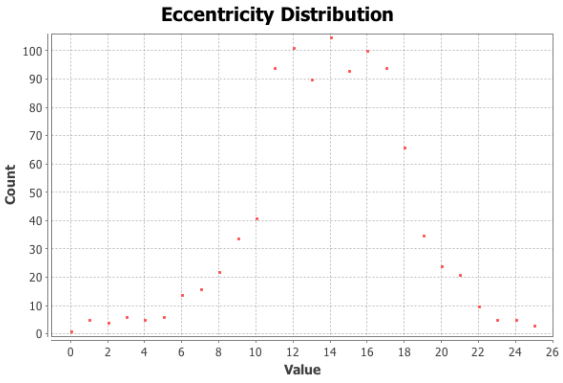

Degree Distribution
Count
Value
0
50
100
150
200
250
300
350
400
5
6
7
8
9
10
11
12
13
14
15

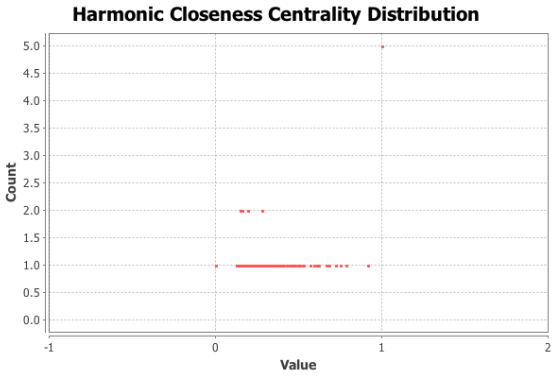

In-Degree Distribution
Count
Value


Out-Degree Distribution
Count
Value

Graph Distance:
Diameter: 25
Radius: 0
Average Path length: 6.794766532562485







Cytoscape:

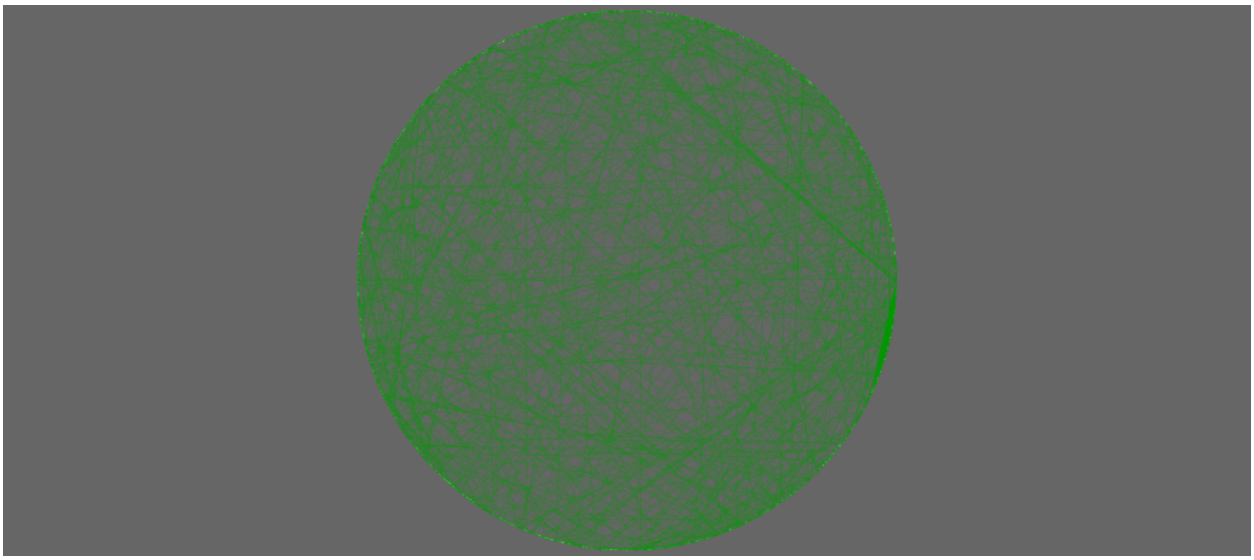
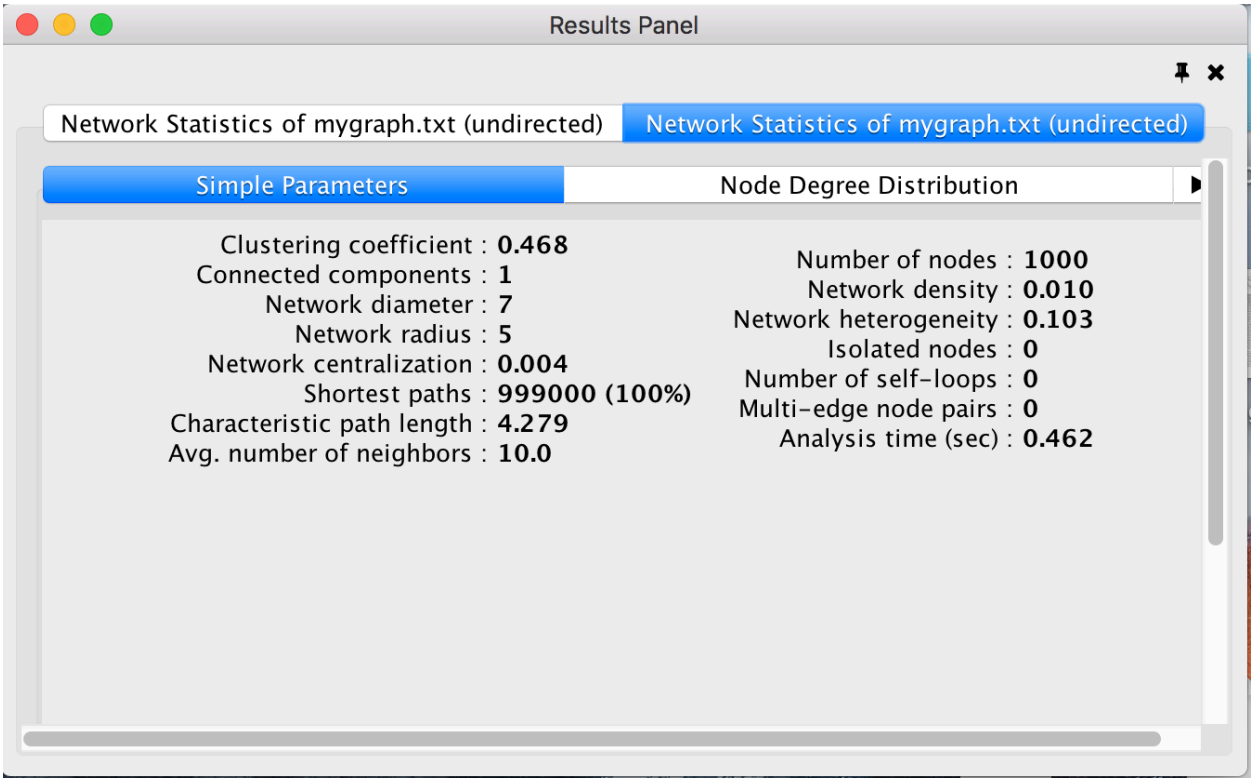


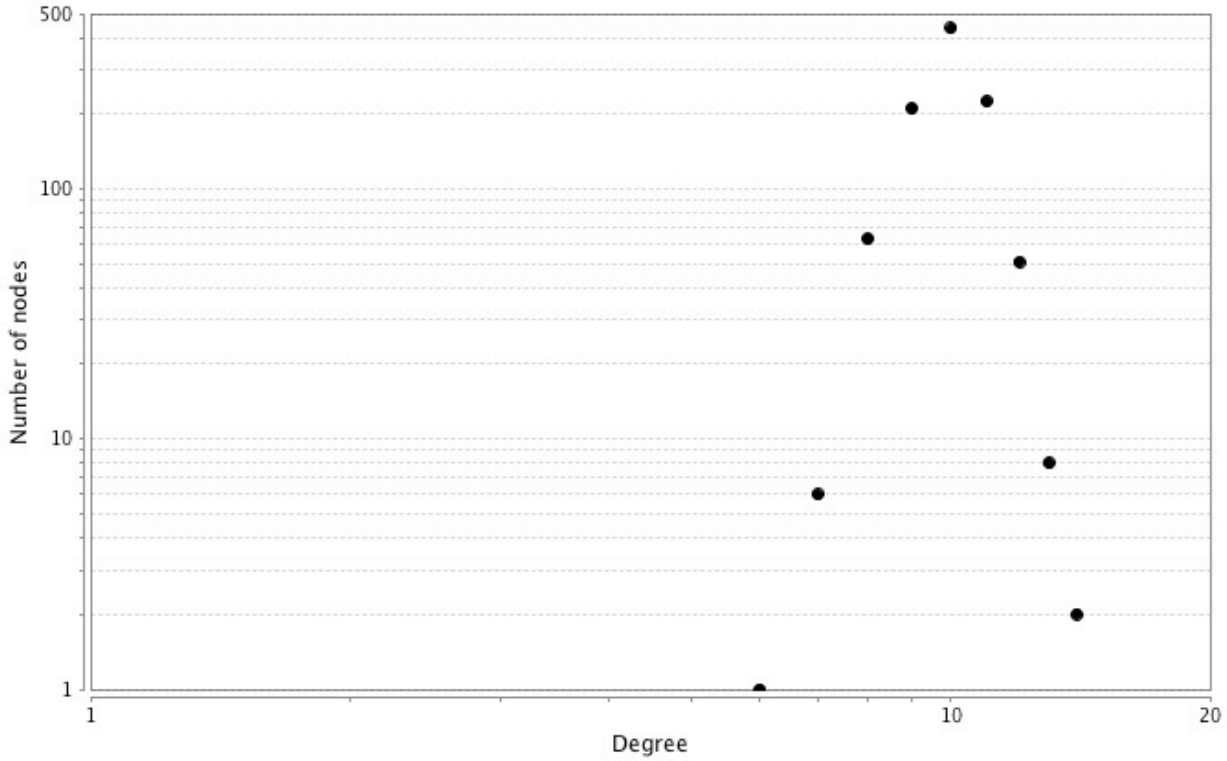
Fig. Random Graph (1000 nodes) visualized on a circular layout



Inferences:

We know that barabasi random generated graphs resemble much similar to the real-world networks. This can also be seen from the visualized forms above with the graphs having similar clustering coefficient to that of ego_facebook dataset. (we basically tried to resemble the randomly generated graph to facebook dataset by maitaining similar number of nodes, facebook: 1034, rndGrapg: 1000 and also similar avg. node

out degree). The graph visualizations of both the tools resembled similar when rendered with similar tuning parameters in the circular layout. Although, the facebook dataset had much more larger number of edges and thus higher density can be obeserved in the ego_facebook graph than the rndGraph.



In both the tools, the node degree distribution plots were similar with Cytoscape providing the plots on a much better scale.