

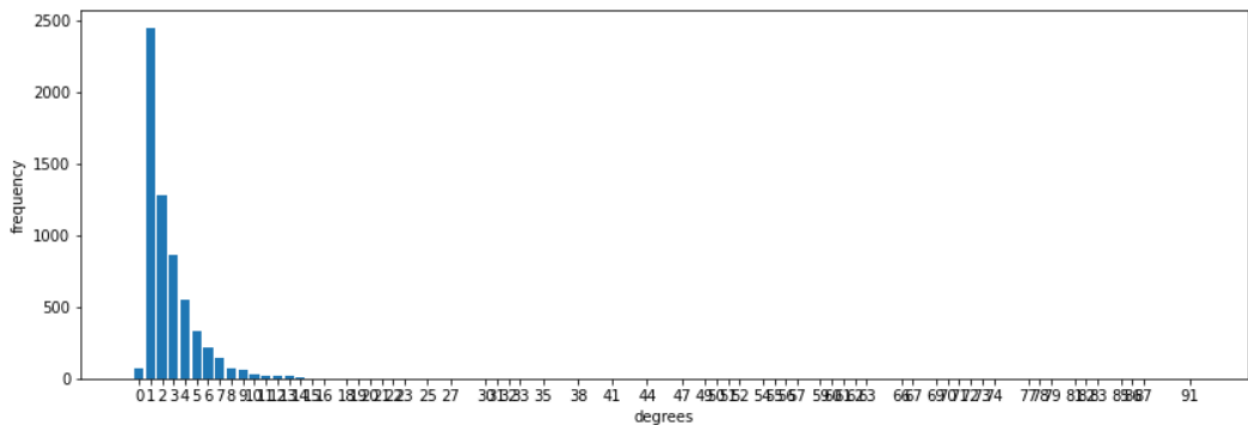
APARNA JHA (2019410)
PRAVEEN SINGH SAMOTA (2020104)

1.

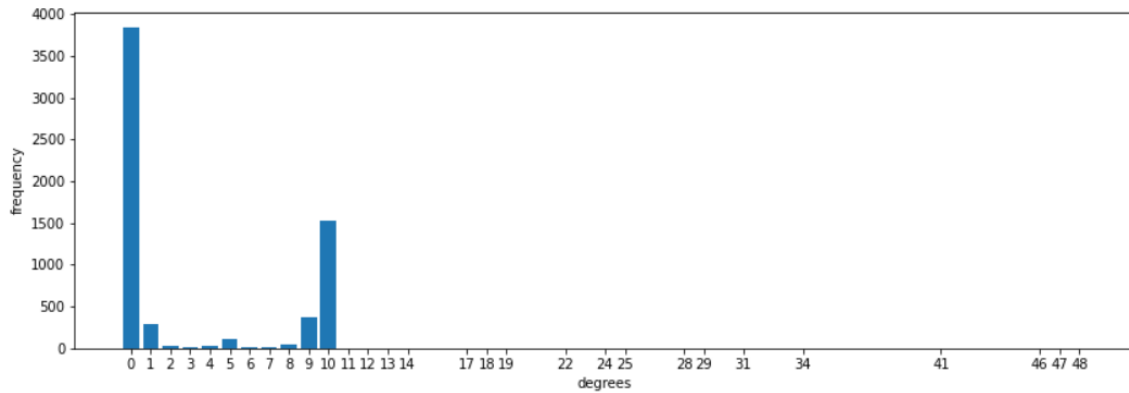
number of nodes are ---> 6301
number of edges are ---> 20777
average In-Degree --> 3.2974131090303125
average Out Degree --> 3.2974131090303125
Node with Max In-Degree ---> 266
Node with Max out-Degree ---> 266
density of network is ---> 0.0005233989061952878

Degree Distribution Plot -

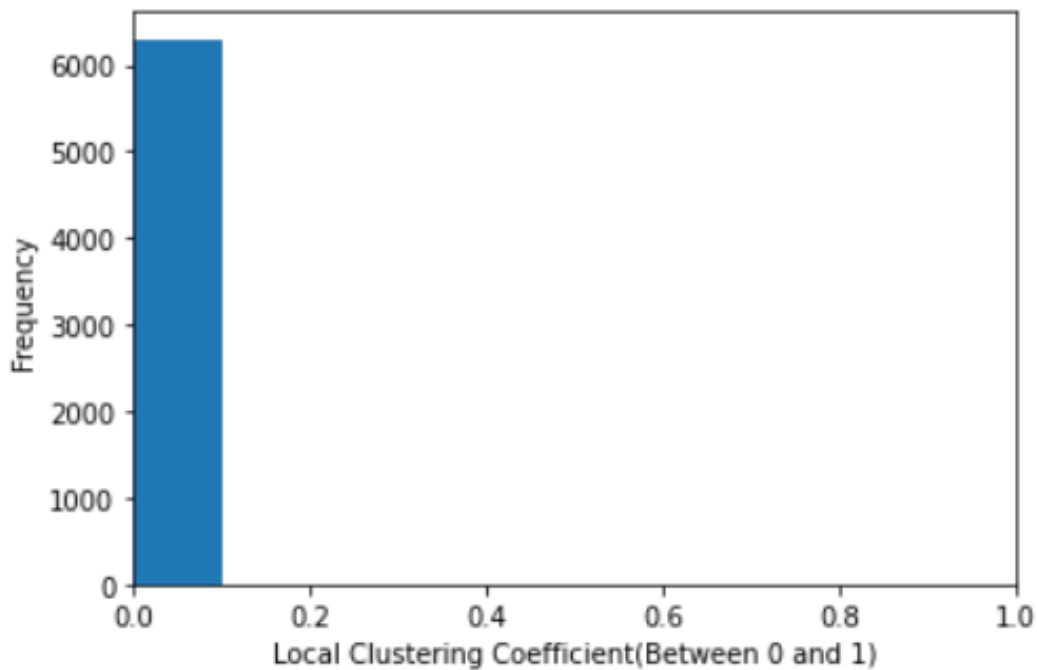
In-Degree -



Out-Degree -



Local clustering coefficient Plot-



Formulas :-

1. Number of Nodes= $\text{len}(\text{node_set})$
2. Number of Edges= total number of directed edges. $\text{len}(\text{edge_set})$
3. Avg In-degree = In degree is the number of nodes where edge directs towards the node.
Average in-degree is total in-degree divided by number of nodes
4. Avg. Out-Degree = Out degree is the number of nodes where edge directs away the node. Average out-degree is total out-degree divided by number of nodes
5. Node with Max In-degree= $\text{max}(\text{in_degree from in_degree list})$
6. Node with Max out-degree = $\text{max}(\text{out_degree from in_degree list})$

7. The density of the network = No. of Observed Edges/(Total number of possible edges)=
 $m/n*(n-1)$

LCC = number of connected neighbours divided by total possible neighbour edges.

2.

----- Top 10 page ranks -----

Node:6139 score: 0.0019551737506193602

Node:1890 score: 0.0016095024506786878

Node:424 score: 0.0014466545135060796

Node:1317 score: 0.0014141933760816008

Node:251 score: 0.0013979841992657967

Node:123 score: 0.0013759146752059636

Node:127 score: 0.0013559400630007543

Node:266 score: 0.0013243598120114045

Node:3 score: 0.0013236953984442335

Node:264 score: 0.0013205432318496876



```
----- Top 10 hub scores ----  
Node:367 score: 0.00705810800027954  
Node:123 score: 0.006736333971554648  
Node:145 score: 0.0061868127585674735  
Node:249 score: 0.006069799234488739  
Node:5 score: 0.0059543261747313754  
Node:127 score: 0.005888964712833159  
Node:353 score: 0.0057534950701790665  
Node:427 score: 0.005719631673350455  
Node:124 score: 0.005704902016225351  
Node:149 score: 0.00566677103736714  
  
----- Top 10 authority scores -----  
Node:367 score: 0.007058108000279543  
Node:123 score: 0.006736333971554655  
Node:145 score: 0.006186812758567477  
Node:249 score: 0.006069799234488747  
Node:5 score: 0.005954326174731376  
Node:127 score: 0.0058889647128331675  
Node:353 score: 0.005753495070179073  
Node:427 score: 0.005719631673350458  
Node:124 score: 0.005704902016225359  
Node:149 score: 0.005666771037367146
```

As we can see the top 10 hub and authority scores are the same but the page rank scores differ. This might be due to the fact that page rank takes the in degree into account while the hub score takes the node and the outdegree into account. Authority scores are high in magnitude only for those nodes who have incoming links from a high number of hubs. Also the hub and authority scores are different. This is because in HITS, a node's hub score is determined by the quality and quantity of outgoing links from that node, while the authority score is determined by the quality and quantity of incoming links to that node. Thus, nodes that have a high authority score may not necessarily have a high hub score, and vice versa.