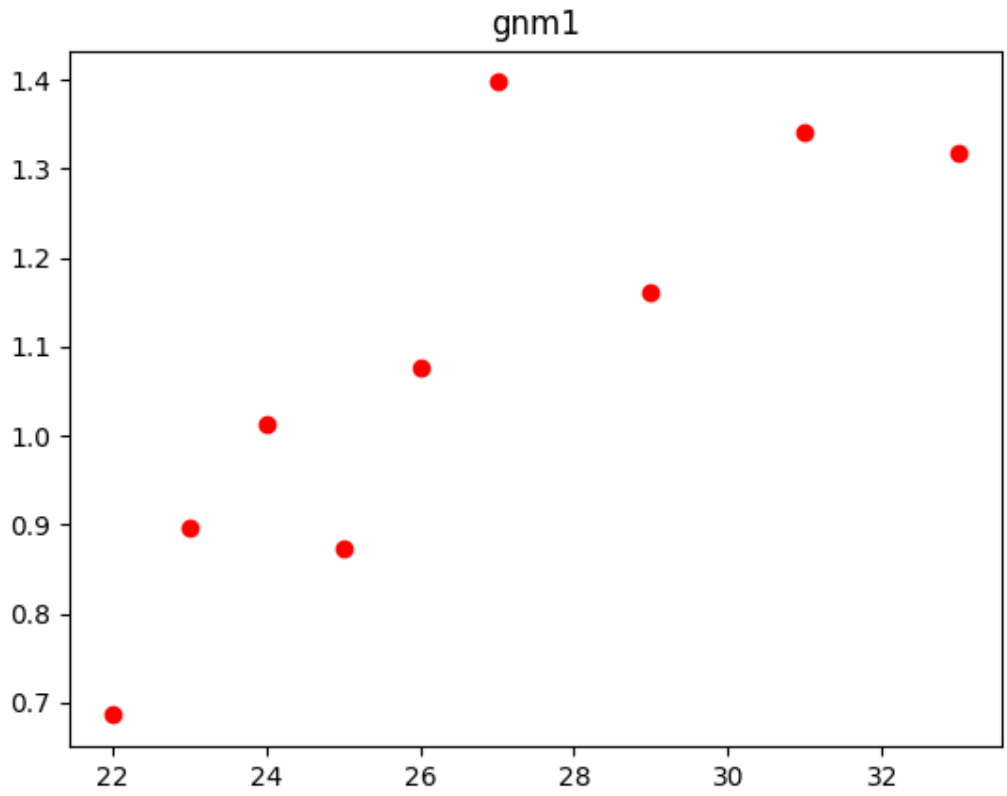
Degree:

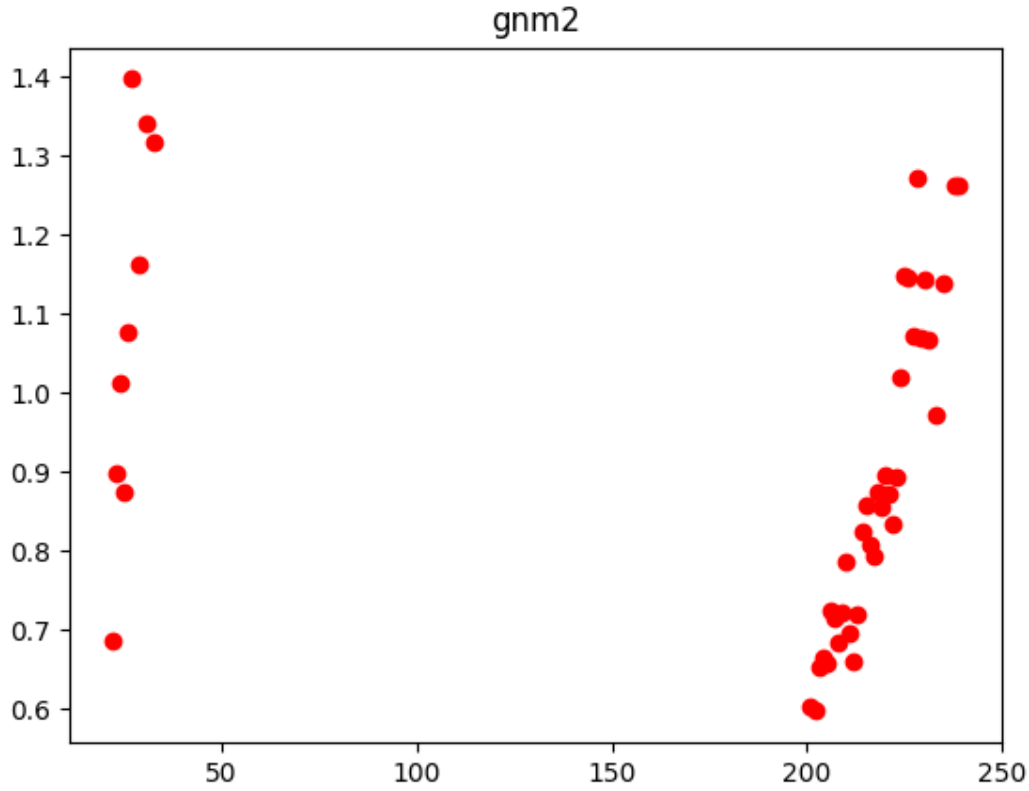
a. Generate a few random graphs. You can do this using networkx's random graph generators. Do the random graphs you tested appear to be scale free? (Include degree distribution with your answer).

Ans. Created the random graphs from the code present in degree.py file, results are noted as below:

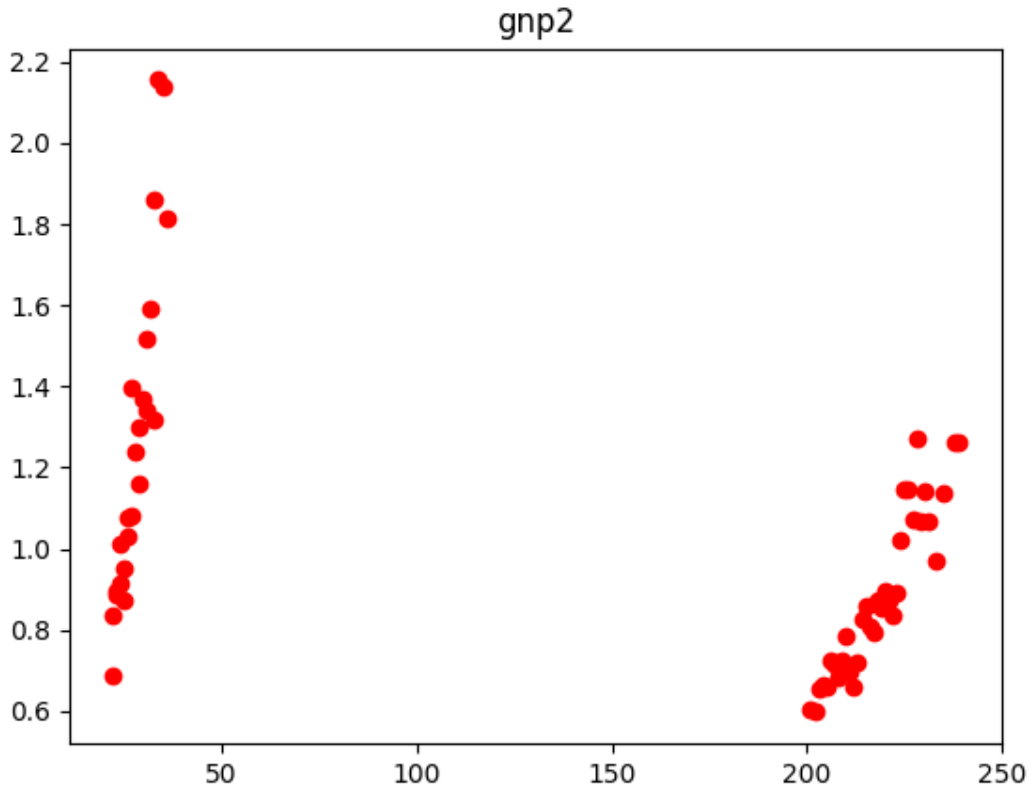
1. The graph titled: random_graph_1.png doesn't appear to be scale free



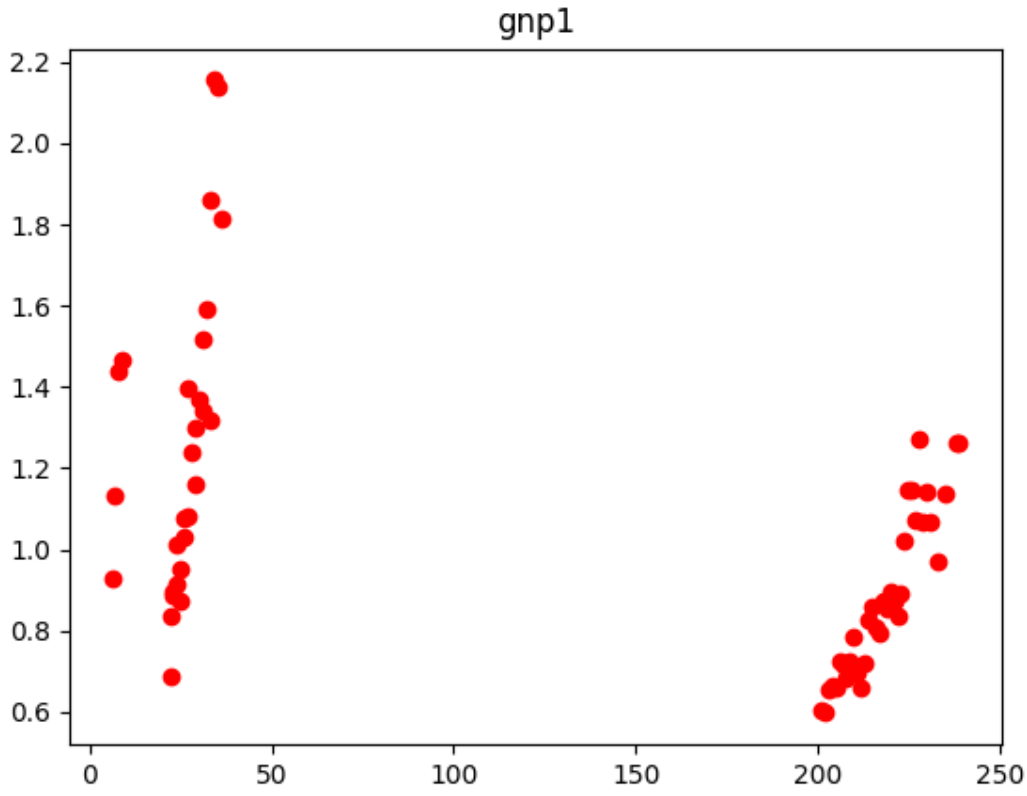
2. The graph titled: random_graph_2.png doesn't appear to be scale free



3. The graph titled: random_graph_3.png doesn't appear to be scale free



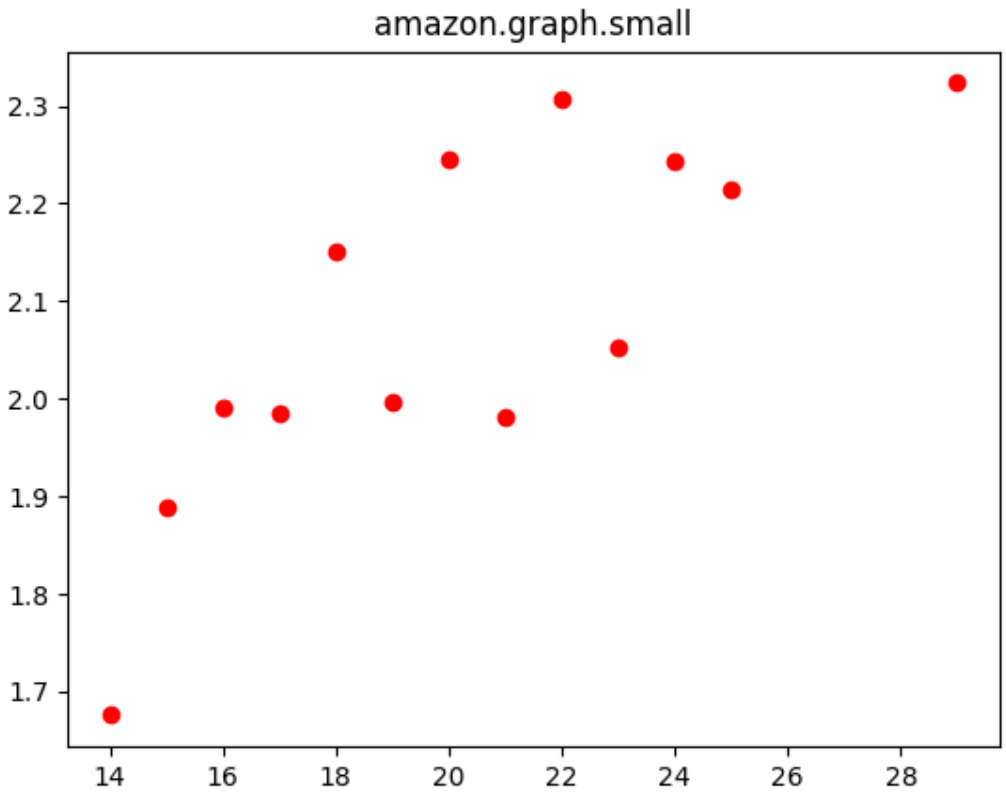
4. The graph titled: random_graph_4.png doesn't appear to be scale free



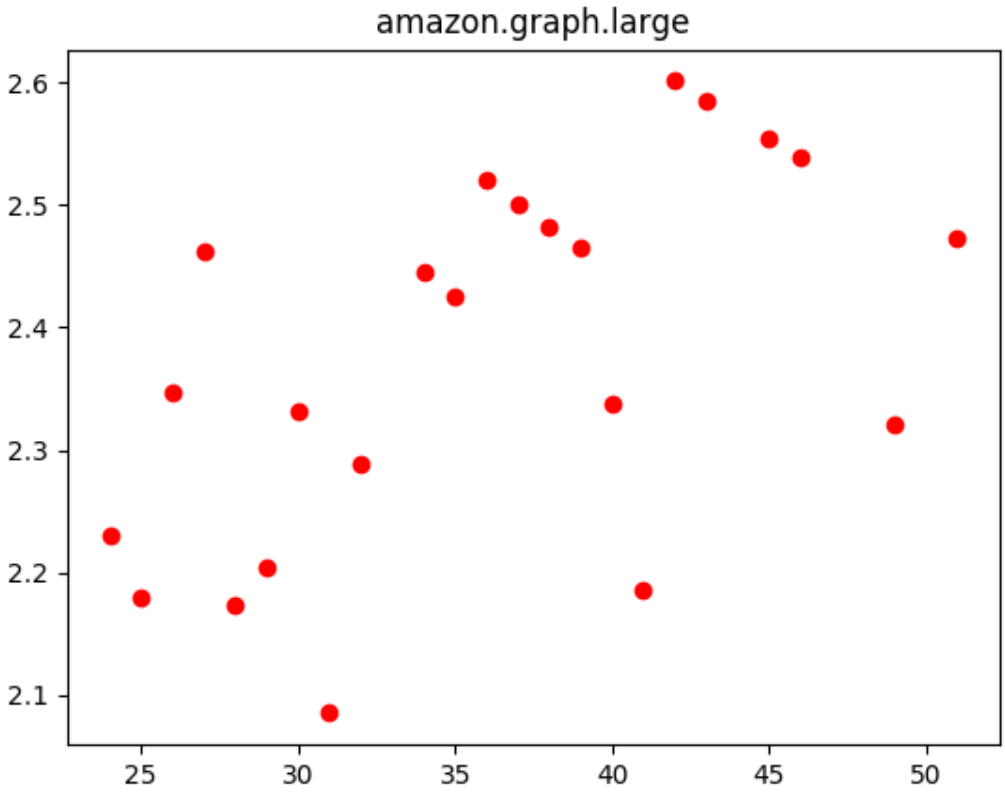
b. Do the Stanford graphs provided to you appear to be scale free?

Ans.
Definition: A **scale-free network** is a network whose degree distribution follows a power law, at least asymptotically. That is, the fraction $P(k)$ of nodes in the network having k connections to other nodes goes for large values of k as where gamma is a parameter whose value is typically in the range 2 < gamma < 3 (wherein the second moment of k^(-gamma) is infinite but the first moment is finite), although occasionally it may lie outside these bounds.

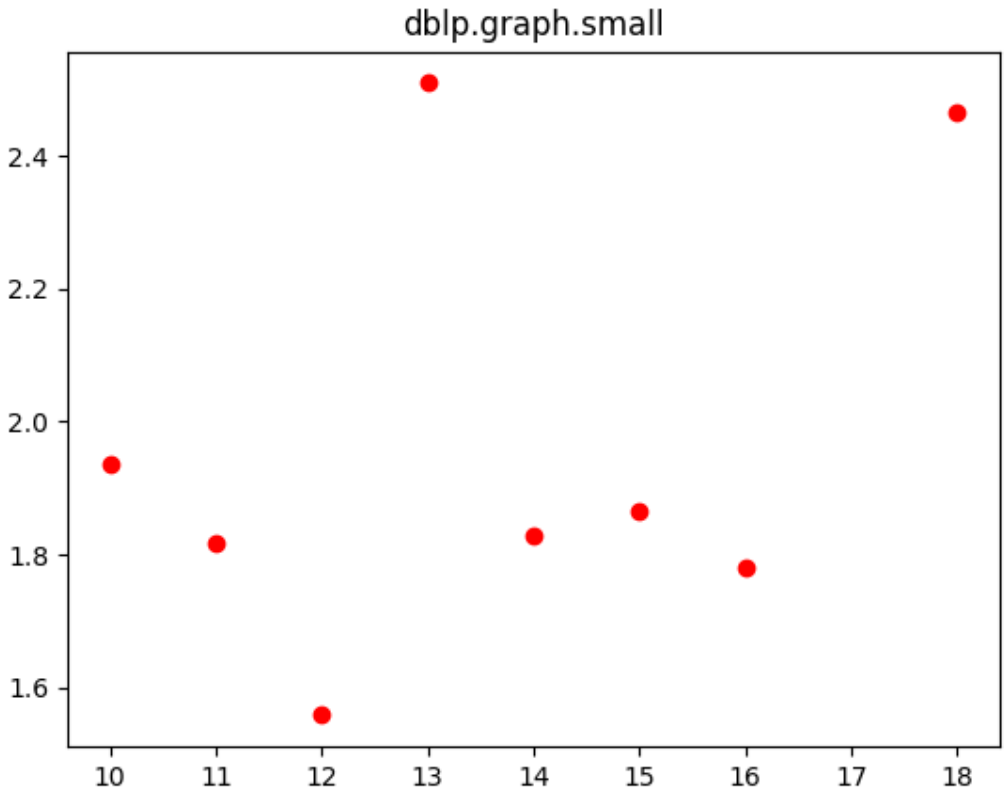
i. Amazon.small –> yes, it appears to be scale free graph, as lambda values for the top 50% of large K lies between 1.9 & 2.4 – Refer the graph below:



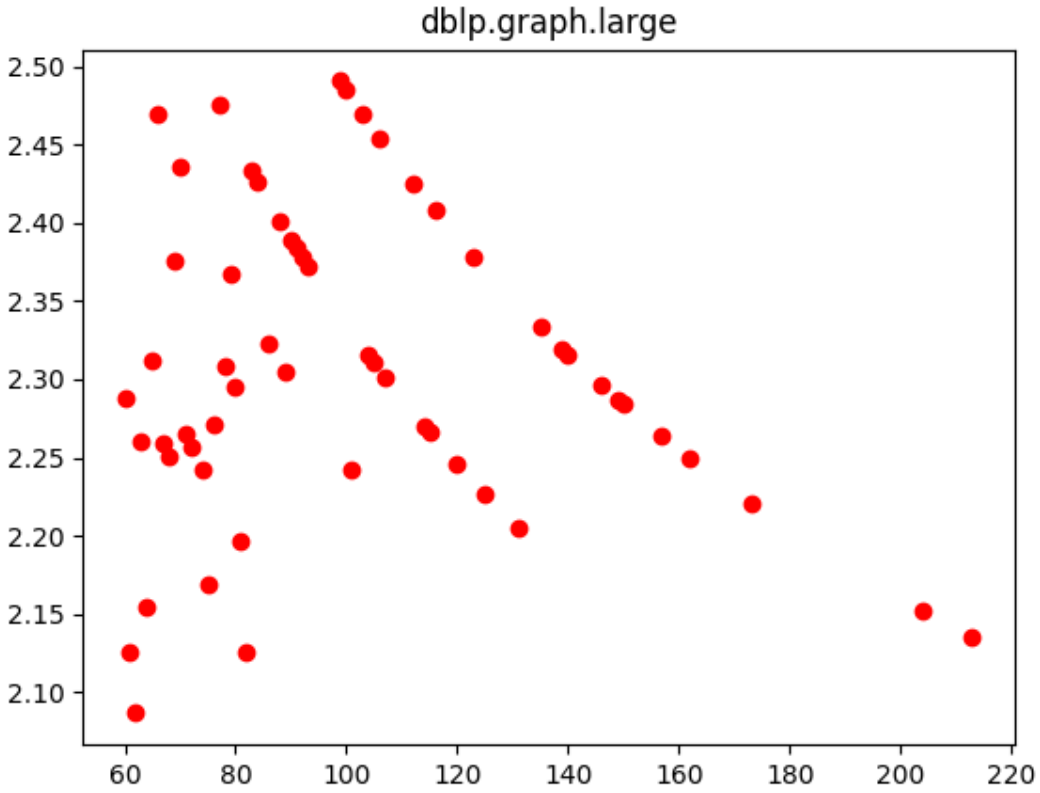
Amazon.large –> yes, it appears to be scale free graph, as lambda values for the top 50% of large k lies between 2 & 2.7 – Refer the graph below:



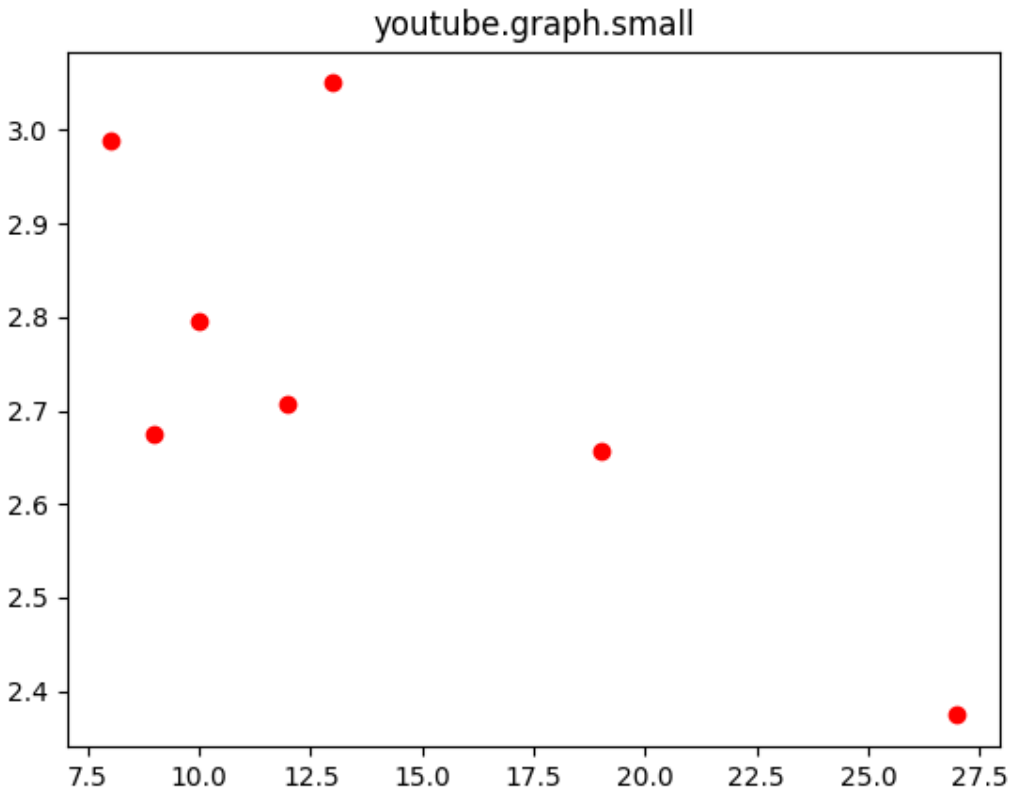
ii. Dblp.small –> yes, it appears to be scale free graph, as lambda values for the top 20% of large K lies between 2 & 2.6 – Refer the graph below:



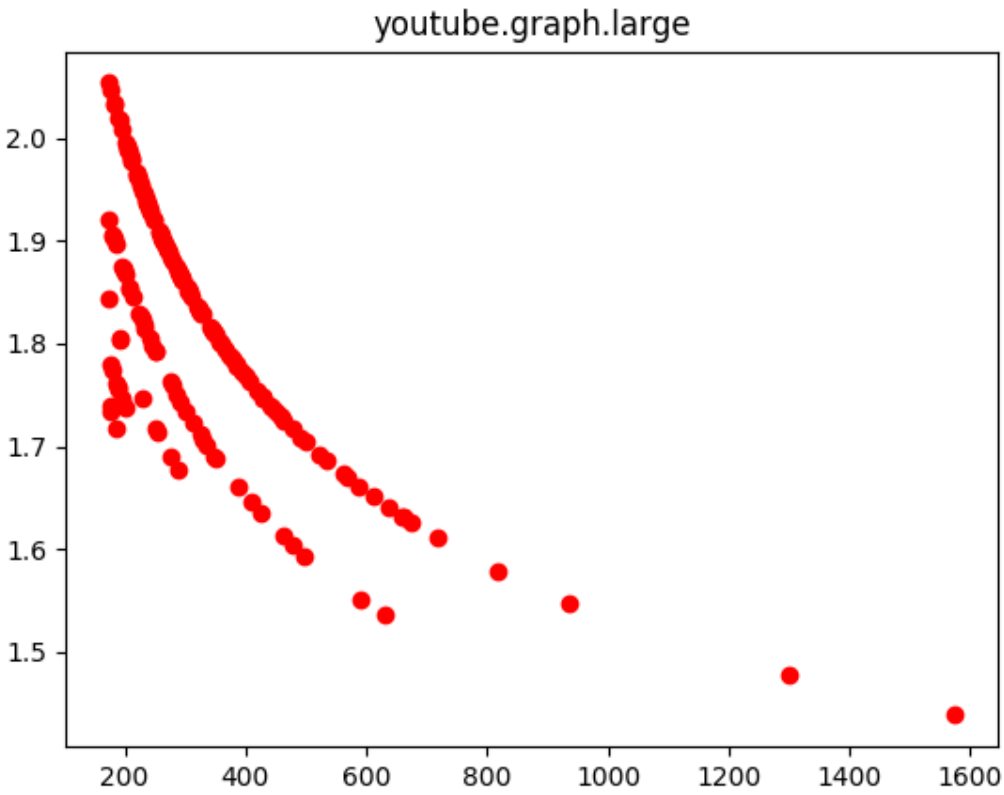
Dblp.large –> yes, it appears to be scale free graph, as lambda values for all data points appears to lie between 2 & 2.5 – Refer the graph below:



iii. Youtube.small –> yes, it appears to be scale free graph, as lambda values for all data points appears to lie between 2.4 & 3.1 – Refer the graph below:



Youtube.large –> yes, it appears to be scale free graph, as more than 50% of the data points appears to have lambda values lie between 1.7 to 2.1 – Refer the graph below:



Centrality:

a) Rank the nodes from the highest to lowest closeness centrality:

Ans:

id	closeness
C	0.0714285714
F	0.0714285714
D	0.0666666667
H	0.0666666667
B	0.0588235294
E	0.0588235294
A	0.0555555556
G	0.0555555556
I	0.0476190476
J	0.0344827586

b) Suppose we had some centralized data that would sit on one machine but would be shared with all computers on the network. Which two machines would be the best candidate to hold this data based on their machines having few hops to access this data?

Ans: Machines '*C*' & '*F*' would be the best candidates to hold the data, as they have the highest closeness as compared to all the other nodes.

Articulation Points:

a) In this example, which members should have been targeted to best disrupt communication in the organization?

Ans: Listed below are the articulation points:

Mohamed Atta
Usman Bandukra
Mamoun Darkazanli
Essid Sami Ben Khemais
Djamal Beghal
Nawaf Alhazmi
Raed Hijazi