

CSE416A hw2

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1 Question 1

(a)

The minimum possible value of span would be 3.

Local bridge is defined as if the local bridge is deleted the distance between these two nodes will be increased to a value strictly more than two, which means the distance its endpoints would be from each other if the edge were deleted is 3.

(b)

For a v satisfy the strong triadic closure in a system contain 3 points (u,v,w) , and there is an existing edge between v and w . Suppose there exist an edge $u-v$ such that it is a local bridge and it is a strong tie. Then $u-w$ must exist because v satisfy strong triadic closure.

However, if $u-w$ exist then it can not be the case that $u-v$ is a bridge. Therefore if node v satisfies the Strong Triadic Closure and is involved in at least two strong ties, then any local bridge it is involved in must be a weak tie.

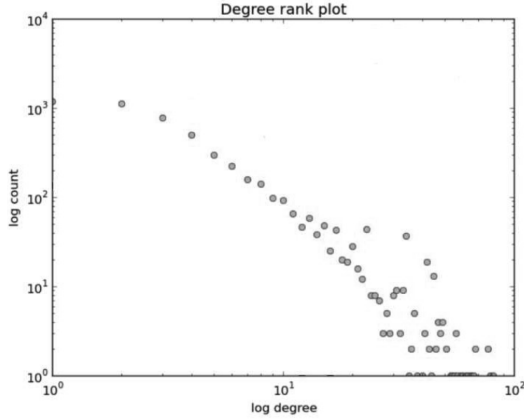
2 Question 2

See Code Submission.

Problem 3: Network Characteristics

3.1: Degree Distribution

(i)

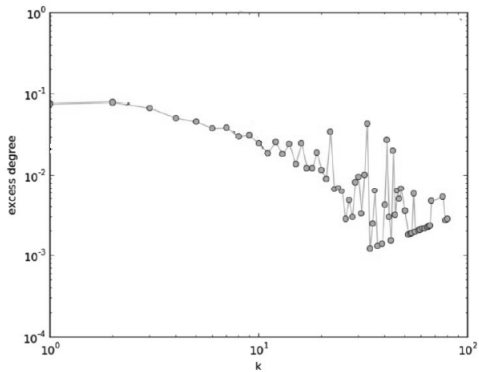


(ii)

After plotting using log-log scale, data points align along 2-dimensional straight with some noise. Like most of the real world graph, there are a large majority of nodes have low degree but a small number of "hubs" have high degree. In this context, "hubs" could represent experts in the quantum cosmology field who are involved in a large number of publication, while other researchers only collaborated with a small number of people.

3.2: Excess Degree Distribution

(i)



(ii)

From the plot of both degree distribution we can see that the degree distribution seems to have greater range and excess degree distribution is more "flat", which suggest the count of nodes (number of researchers) with high and low excess degree are closer compared to that with high and low degree. Intuitively, if we select a random edge (collaboration) from the data set, the endpoints have a higher likelihood to have a large degree than we would expect from selecting a random nodes (researcher).

(iii)

Expected Degree of the network is **5.53** and Expected Excess Degree of the network is **15.87**.

(iv)

$$q_k = \frac{(k+1)Np_{k+1}}{E}$$

Given that N is total number of node and E is the total number of edge.

3.3: Clustering Coefficient

(i)

The average clustering coefficient is 0.5314

(ii)

Since we only computed the average clustering coefficient it does not tell us too much about the collaboration. The high average coefficient might suggest that there are some papers have a large number of authors and since there will be an edge between all pair of co-authors, those nodes will form a large connected component and have high clustering coefficient. Thus result in a high average clustering coefficient.