Kashif Ahmad
kac160230

SYSM 6302.001
Lab4

Q.1)write down your (visual) observations about the diameter of the network with only the local connections and then with the random connections added in. In the first case, without random connections, why is the diameter so high?

Ans) Diameter with local connections is large compared to the nodes. Its about 5 because the nodes have edges in a certain pattern, each node is connected to the next 2 nodes so the diameter can be found by skipping a node and counting the edges which is roughly 5 in this case

In the case of random connections it decreases because there is less order now and every node can be reached in roughly 2 hops

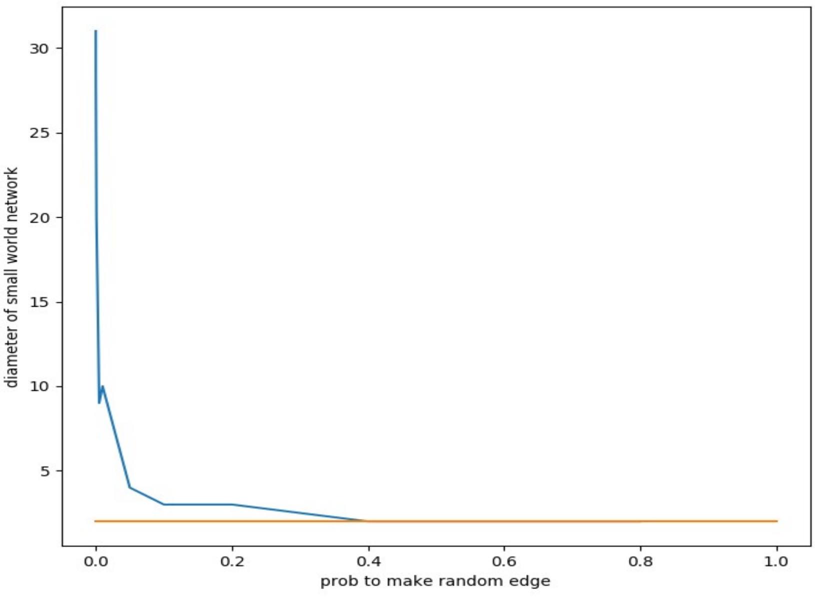
The diameter is high because small world affect isn't observed in this patterned connection, real life networks are mostly small world networks in which every node can be reached in roughly 3 hops.

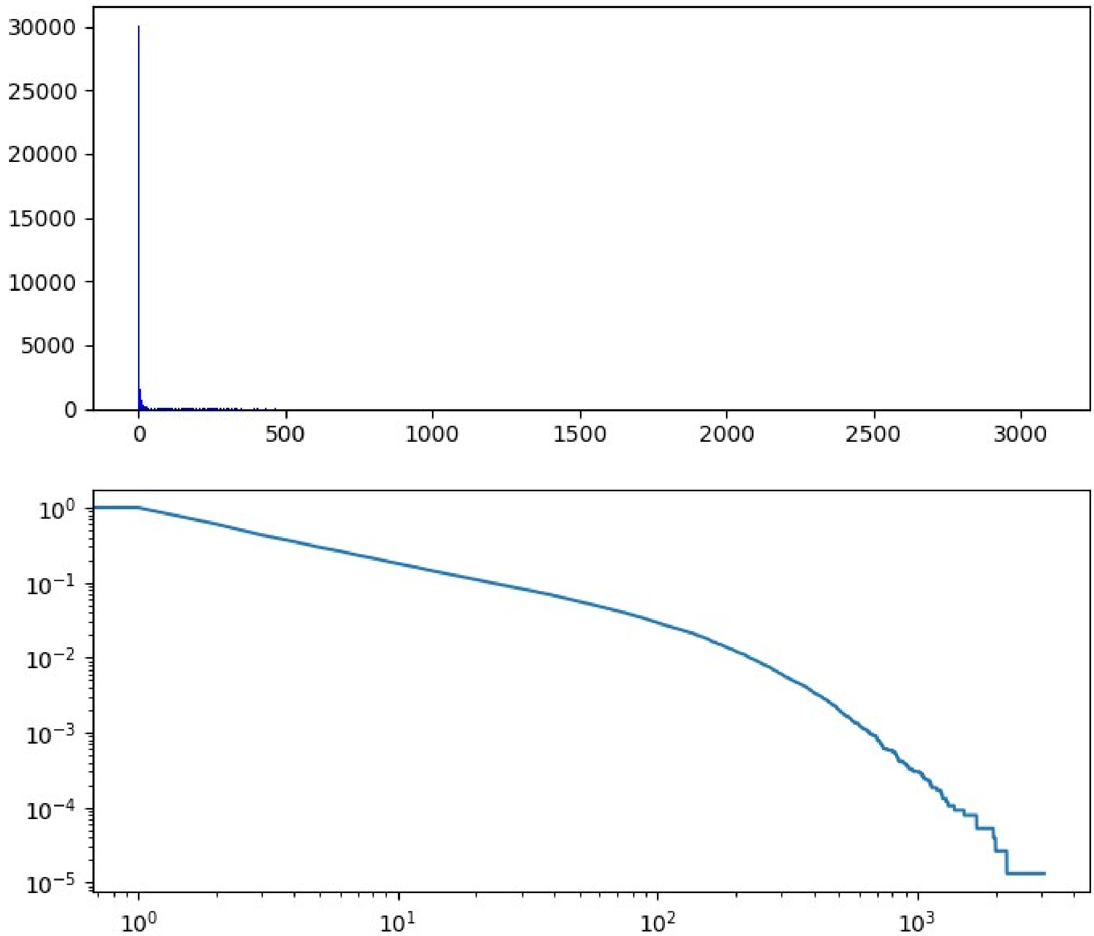
Q.2) Make a brief comment on the how and why these random connections (qualitatively) lead to the small world effect.

Ans) These lead to a small world effect by introducing edges randomly and that means that the longest shortest path can be found out by using less hops to the farthest node. This is a real life phenomenon

Q.3) use these functions to create two plots - one of the degree distribution, which will be a bar plot, and one of the cumulative degree distribution

Ans)





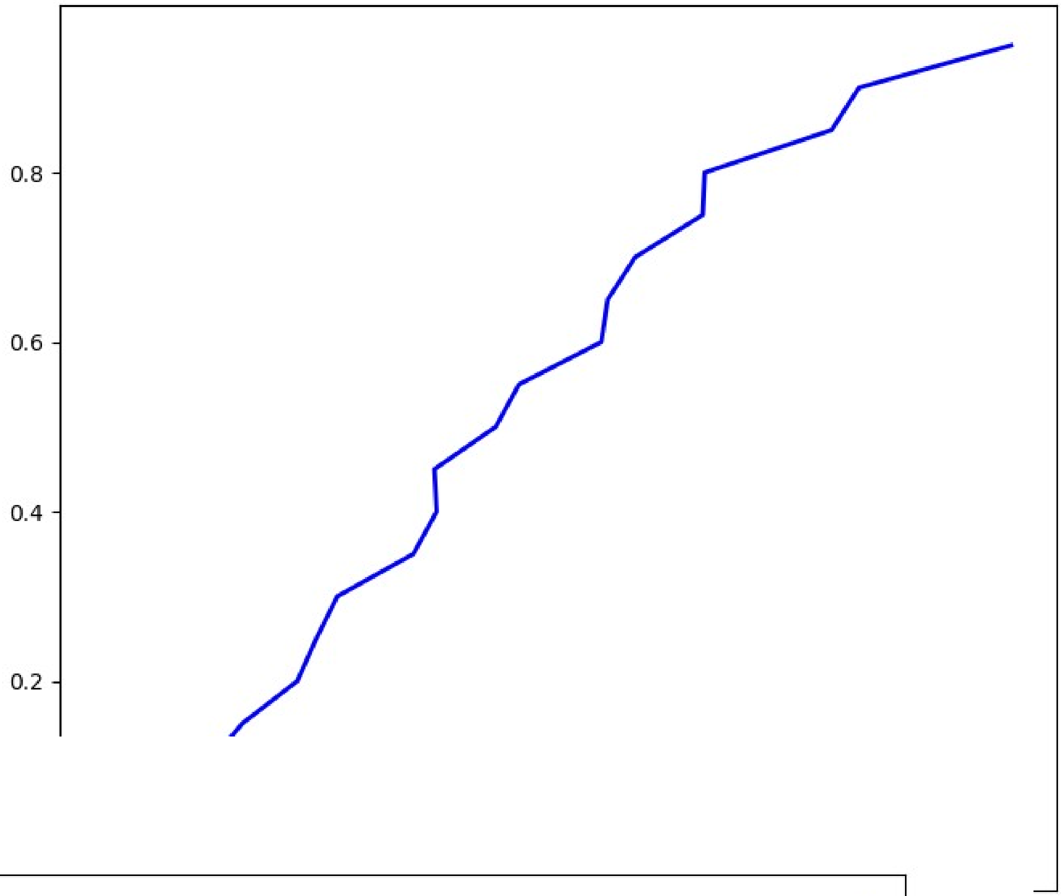
Q) calculate α and the corresponding uncertainty, σ

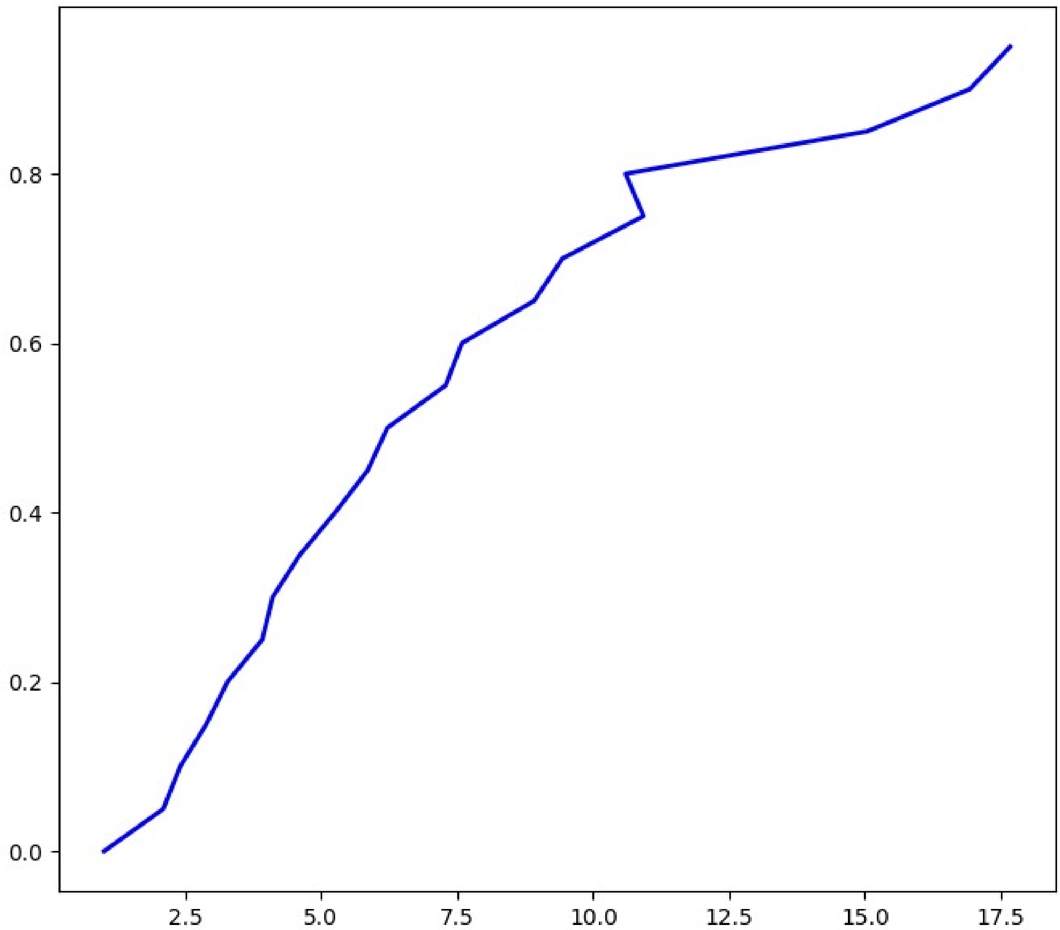
1.19 +/- 0.01
5.06 +/- 0.50
2.20 +/- 0.02

Q) Why are u seeing this nonmonoatomic behaviour
Ans) we have plotted for only one set of values, this is a real world phenomenon that needs to be averaged over several iterations to see the phenomenon, however we do notice what the graph is approaching and how it starts elevating when the degree is 1

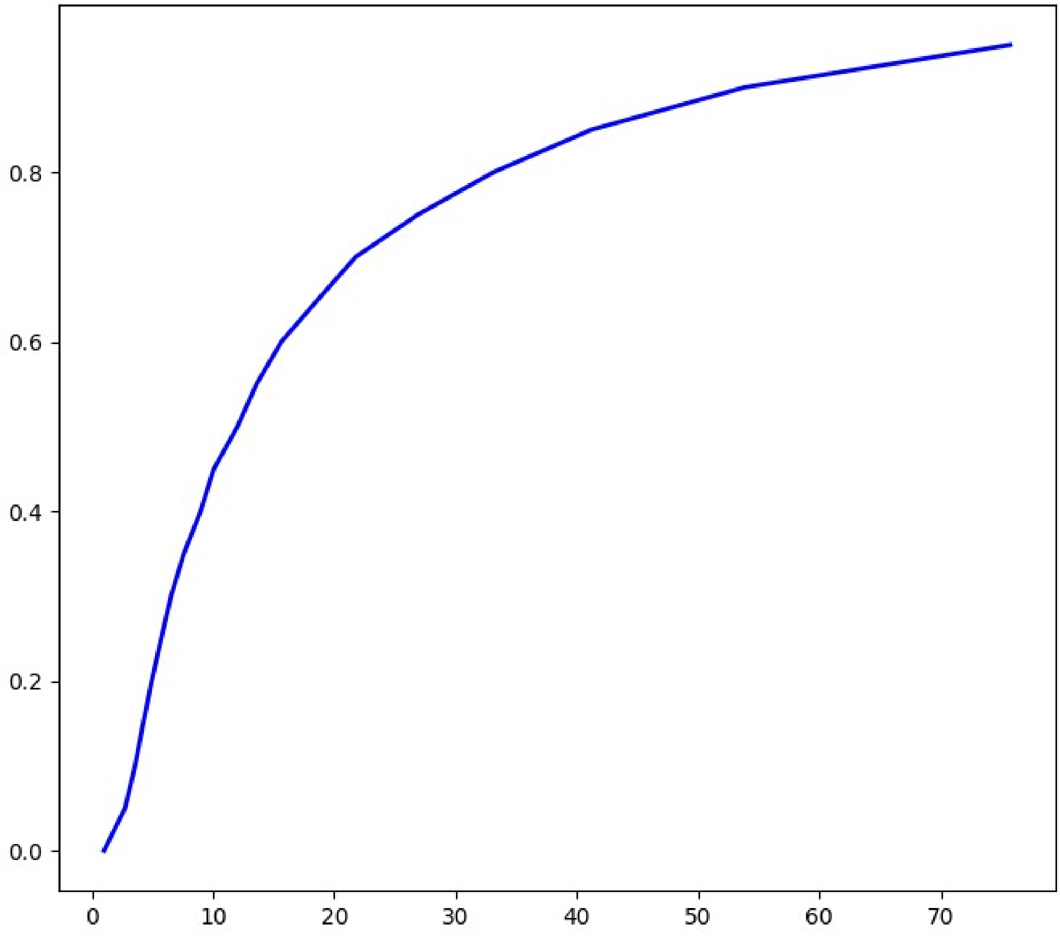
Q) Make three plots
Ans)

for n = 10





for n = 100

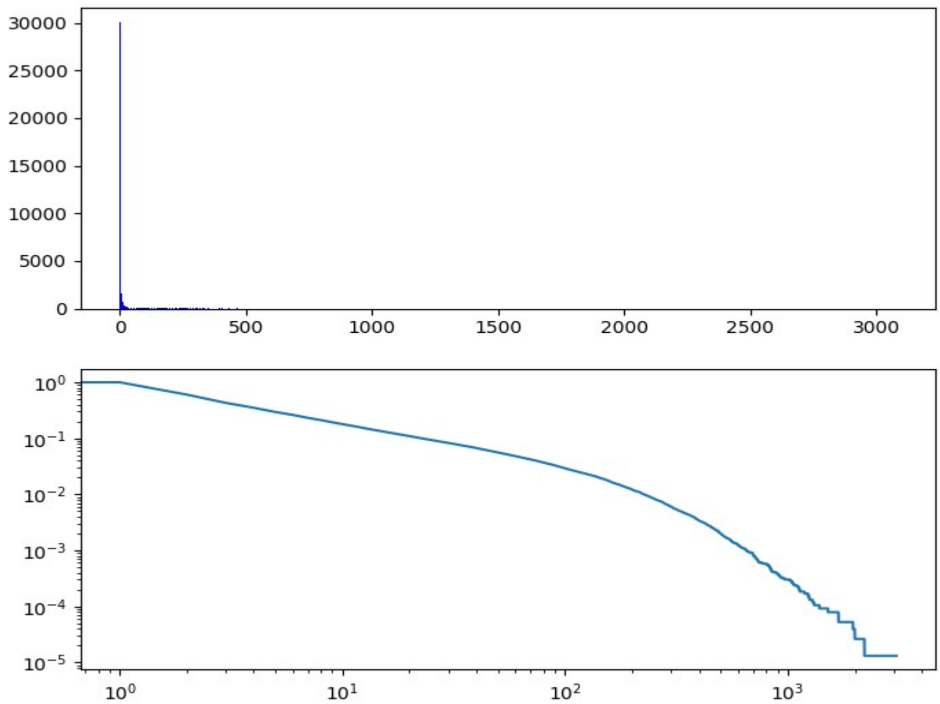


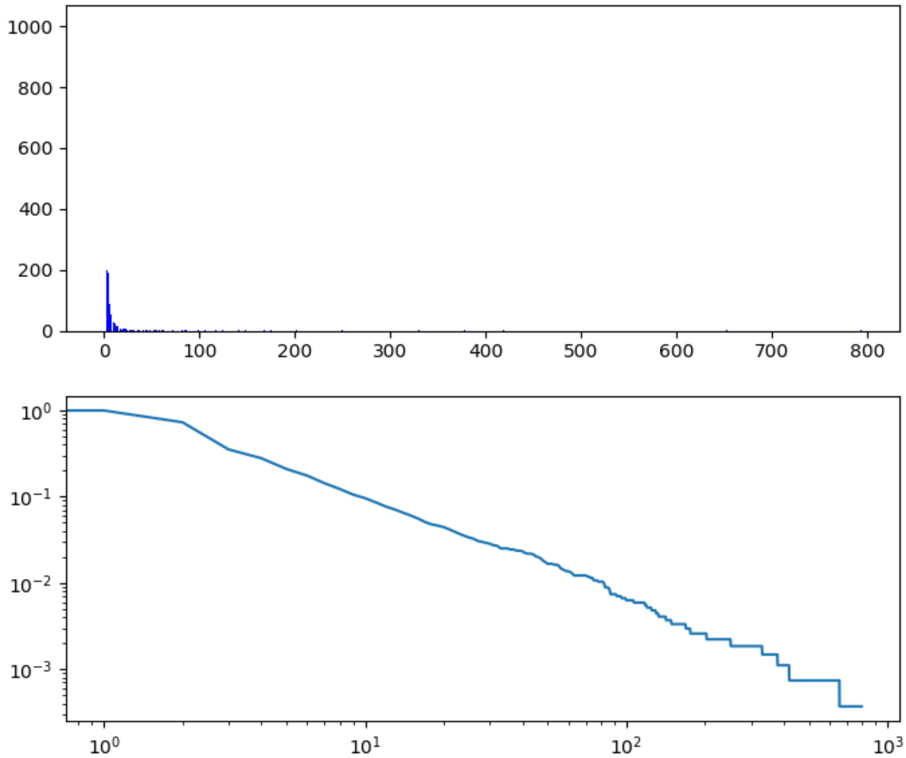
for n= 1000

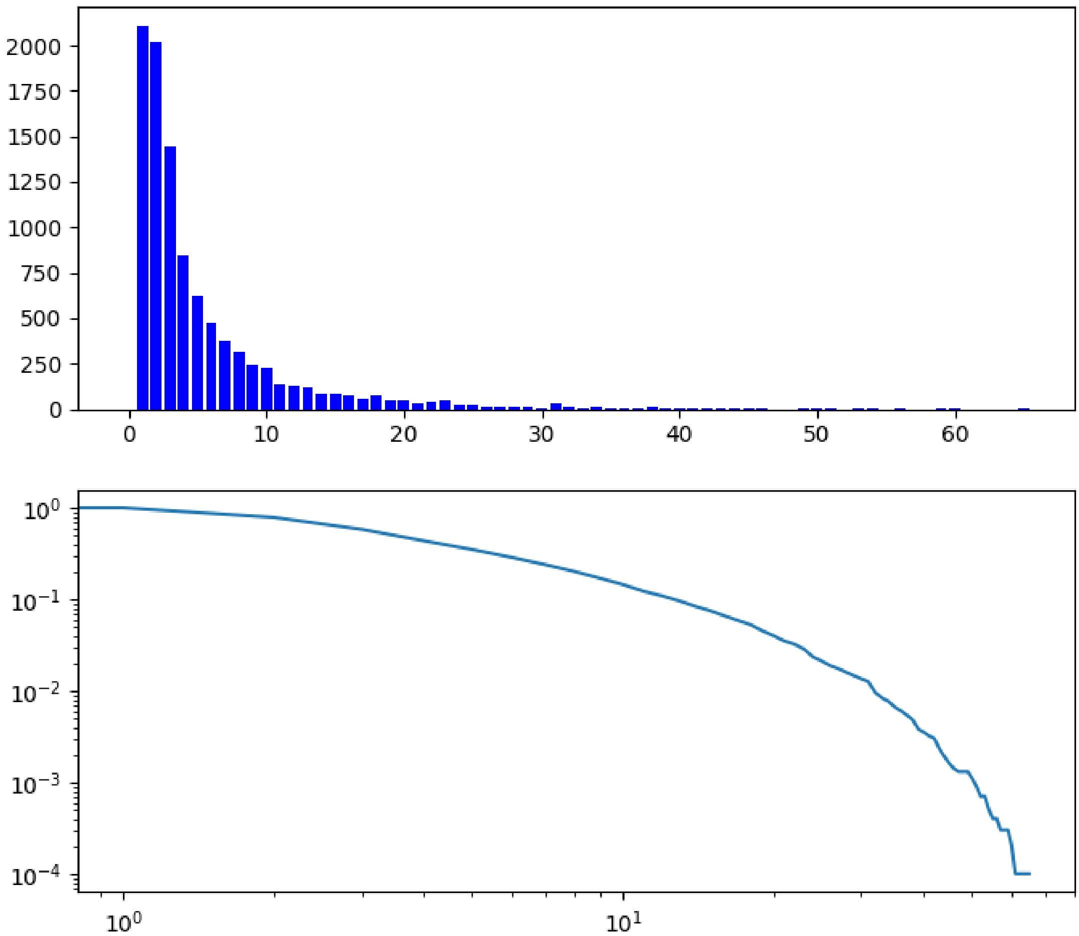
Q) Observe the differences in the plots
Ans) the graphs become a lot more smooth because the graph size increases, affects like these can be observed better with graphs which have a large number of nodes, furthermore the graph seems to level off when the S reaches 1, the degree approaches high values. The balue 1 is never quite reached though, because the graphs dont have every edge connected to every node.

Note :- couldnt plot the standard deviation values because I did the mean manually by using a 2d array and I didnt have time to implement the S.D formula

The Power law graphs for different real life graphs:-




1000
800
600
400
200
0
0
100
200
300
400
500
600
700
800
10^0
10^{-1}
10^{-2}
10^{-3}
10^0
10^1
10^2
10^3


2000
1750
1500
1250
1000
750
500
250
0
0
10
20
30
40
50
60
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^0
10^1