PSG COLLEGE OF TECHNOLOGY, COIMBATORE – 641 004
Department of Applied Mathematics and Computational Sciences
15XD98 – Network Science Lab

1. Generate three networks with 1000 nodes which have power-law degree distribution with degree exponent $\gamma = 2.2$. Write R script or Python script, study and visualize the robustness of the three networks against random failures, and compare their $P_\infty(f)/P_\infty(0)$ ratio. Which network is most robust? Explain

2. Calculate the critical threshold f_c for networks with Power law with exponential cutoff and lognormal distribution. Assume that the networks are uncorrelated and infinite. Discuss the consequences of the obtained results for network robustness by visualizing the network through R script or Python script.

3. In Big Brother society, the thought police wants to follow a "divide and conquer" strategy by fragmenting the social network into isolated components. You belong to the resistance and want to foil their plans. There rumours that the police wants to detain individuals that have many friends and individuals whose friends tend to know each other. The resistance puts you in charge to decide which individuals to protect: those whose friendship circle is highly interconnected or those with many friends. To decide you simulate two different attacks on your network, by removing (i) the nodes that have the highest clustering coefficient and (ii) the nodes that have the largest degree.

   Write R script or Python script to study the giant component in function of removed nodes for the two attacks on the following network:

   i)   A network with 1000 generated with the configuration model and power law degree distribution with $\gamma = 2.5$

   Which is the most sensitive topological information, clustering coefficient or degree, which if protected, limits the damage best? Would it be better if all individuals' information could be kept secret? Explain.