Assignment 1

הגשה 7.6.24- 7 יוני,2024

Please combine any code together with text responses in a single upload file to Lemida by the deadline.

1. Read in the file uploaded with the assignment **airport-network.gml**. You can read the file into network using the network command *nx.read_gml('airport-network.gml')*, where the argument in the middle is the filename.
    a. Make a log-log plot of the degree distribution of this network. Also compute its global clustering coefficient using the command *nx.transitivity(G).*
    b. Make an Erdos-Renyi Graph with the same average degree as this network and plot its degree distribution. You may use the network command nx.erdos_renyi_graph(), with the appropriate values of *N* and *p* (you will have to calculate the correct *p*). Compare this to the actual degree distribution
    c. Using *nx.configuration_model(G)*, create a network with the same degree distribution as the original network and compare its clustering coefficient value.

2. Consider an Erdos-Renyi network with N=6,000 nodes, connected with probability p=0.0001.
    a. What is the expected number of links L?
    b. In what regime is the network (critical, subcritical, supercritical, fully connected).
    c. Assuming the same value of p, what value of N would lead to a network with an average degree of k=10.

3. Degree and components
    a. Consider an undirected network of size N in which each node has exactly degree k = 1 (not average degree k=1!). What has to be true of N for this network to exist? What is the degree distribution of this network? How many components does this network have?
    b. Consider now a network in which each node has degree k = 2 and clustering coefficient C = 1. What has to be true of N for this network to exist? Describe what this network looks like.