DCS 3350: Contagion
Assignment 1 (100 points)
Due: Monday, March 15 by 11:59 PM
Collaboration Level 1 (https://turing.bowdoin.edu/dept/collab.php)

1. Create a Barabasi-Albert preferential attachment network. You have complete freedom over the parameters. Create small networks for visualization and debugging and large networks for the final submission.

2. Compute the average degree for later use.

3. Apply the SI model to the network.
    a. Initially, only one randomly chosen node is infected.
    b. At each subsequent time step, each infected node transmits the pathogen to each of its susceptible contacts with probability ß. Try to visualize the process using node colors.
    c. Compute the characteristic time by simulation. That is, find the number of time steps needed to infect ~36% of the nodes.

4. Change the network size (measured by the number of nodes) and ß values and redo the above experiment. This step is open ended, but you should try at least three different network sizes and at least two different ß values.

5. Redo the above steps by replacing Barabasi-Albert networks with Erdos-Renyi random networks in Step 1.

Deliverables:

1. For each of the two types of networks (Barabasi-Albert and Erdos-Renyi), tabulate various network sizes, ß values, average degrees, and the corresponding characteristic times. Explain the finding for each type of network in light of the theory.

2. Do you see a difference between Barabasi-Albert and Erdos-Renyi? Explain the difference between the two types of networks in light of the theory.

Submit your Python code and a written report on Blackboard. The explanation part of the report should be limited to 750 words.