

PHYS 597A, CMPS497E: Graphs and networks in systems biology

Homework assignment 8, due Tuesday March 24

1. Construct a graph with eight nodes and twelve edges (you can do it randomly or select an example that seems interesting).

(a) Rank order the nodes by your expectation for the severity of the effect of their removal on the connectivity of the network. What were your criteria in doing so?

(b) For each node, determine what is the effect of its removal on the size of the connected component, the diameter of the connected component, and a third measure of your choosing. Rank order the nodes based on these three measures. Do the results match your expectations?

2. Consider a disease spreading process in a fully mixed population where individuals can be in one of three states: susceptible, infected/infectious, and recovered/immune. At the onset of the infection there is a single infectious individual and 10% of the population is immune.

(a) Write down the equations describing the rate of change of the fraction of susceptible, infected and recovered individuals.

(b) What are the main parameters influencing the disease spreading process?

(c) Describe the initial condition, i.e. the initial values of s , i and r .

(d) Under what condition does the infection have a chance to take off?

(e) What is your expectation for the values of s , i and r in the steady-state behavior (after a long time)?