

# PHYS 597A: Graphs and networks in systems biology

## Homework assignment 7, due Tuesday March 4

1. Consider a growing network generated by the following algorithm.

Start with a completely connected graph with four nodes (one "central", three peripheral). At each timestep, make three copies of the graph, keep the original in the center. Connect the peripheral nodes of each copy to the central node of the original.

- (a) How does the number of nodes increase as a function of steps?
- (b) How does the number of edges increase as a function of time steps?
- (c) How does the degree of the central node increase in time?
- (d) Extra credit: derive the degree sequence (i.e. what degrees are represented) and the degree distribution (the fraction of nodes with a given degree).

2. Construct a graph with at least ten 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 average path length 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?