

PHYS 597A, CMPSC 497E: Graphs and networks in systems biology

Homework assignment 5, due Tuesday Oct. 6

1. The Sept. 24 lecture surveyed a number of graph processing and visualization tools. Install one of them and use it to draw and analyze a graph. Provide a screenshot of your work and a two-three paragraph overview of what the software/library can do, what you did with it, and your assessment of the process of accomplishing the desired outcome.

URLs to the tools discussed in the lecture:

GraphViz: <http://www.research.att.com/sw/tools/graphviz/>

Pajek: <http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

Yed: http://www.yworks.com/en/products_yed_about.htm

NetworkX: <https://networkx.lanl.gov/>

Cytoscape: <http://www.cytoscape.org/>

UCINET: <http://www.analytictech.com/ucinet/>

igraph: <http://igraph.sourceforge.net/>

2. Answer the following questions:

a) At what connection probability you expect the existence of (i) a tree with six nodes, (ii) a cycle with six nodes, and (iii) a completely connected subgraph with six nodes in a large ($N \rightarrow \infty$) random graph?

b) A random graph has a connected component that unites a large fraction of its nodes. What is our expectation for the graph's average degree?

c) A random graph has the following degree distribution:

$$P(k) = C_{11}^k \left(\frac{1}{3}\right)^k \left(\frac{2}{3}\right)^{11-k} \quad (1)$$

What is the number of nodes and the connection probability? What is the average degree of this graph?