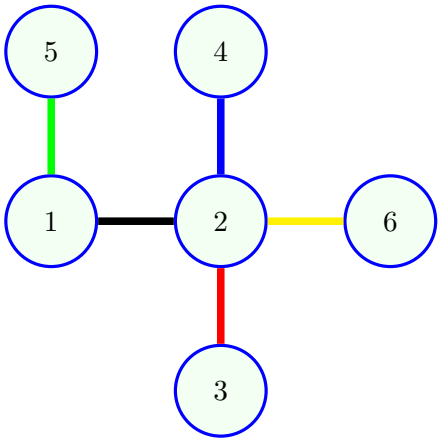
Network Science
Spring 2024
Problem sheet 6



1. Consider the simple Barabasi-Albert model analyzed in lecture with $N_0 = 2$ and $m = 1$. A simulation of the model has generated the graph above at time $t = 4$, $G_1(t = 4)$.

   (a) What is the probability of generating this graph given the graph that existed at $t = 3$?

   (b) What is the probability of the simulation generating this graph?

   (c) What is the expected degree of node 2 at time $t = 5$ given that we have $G_1(t = 4)$?

2. Consider the following modification to the simple Barabasi-Albert model ($N_0 = 2, m = 1$): a new node connects to any existing node in the graph with equal probability.

   (a) How does the expected degree of a node at iteration $t + 1$, $\langle k_i(t + 1)\rangle$, depend on $\langle k_i(t)\rangle$ and t?

   (b) How does $\langle N_k(t + 1)\rangle$, the expected number of nodes with degree k at iteration $t + 1$ depend on $\langle N_k(t)\rangle$, $\langle N_{k-1}(t)\rangle$ and t? when $k > 1$?

   (c) How does $p_1(t + 1)$, the expected fraction of nodes with degree 1 at iteration $t + 1$ depend on $p_1(t)$ and t?