Social and Economic Networks
Advanced Problems: Week 3

Stanford University Prof. Matthew Jackson

1.

Consider a hybrid growing random network process as discussed in lectures such that a newborn node forms m links with a portion α (with $1 > \alpha > 0$) uniformly at random and a portion $(1-\alpha)$ via preferential attachment. Also, in any given period qm links are destroyed, where $1-\alpha \geq q \geq 0$ and the links are selected uniformly at random out of all links that exist at the end of the period. Solve for the degree distribution under a continuous time mean-field approximation.

2. Suppose that newborn nodes come in groups of n in each period. Suppose that they attach a fraction f of their links uniformly at random to other newborn nodes, and a fraction $1-f$ to older nodes via preferential attachment. Using a continuous time mean-field approximation, develop an expression for the degree distribution.

3. Consider an extension of the hybrid growing random network model discussed in lectures to one where the number of nodes entering at each date grows over time. Let the number of new nodes entering at time t be gn_t, where n_t is the previously existing number of nodes at the beginning of time t and $g > 0$ is a growth rate.

Derive an estimated degree distribution under a continuous time mean-field approximation.