CS60078 Complex Networks
(Spring Semester 2007)

OBJECTIVE

Study of the models and behaviors of networked systems. Empirical studies of social, biological, technological and information networks. Exploring the concepts of small world effect, degree distribution, clustering, network correlations, random graphs, models of network growth, and preferential attachment and dynamical processes taking place on networks.

CONTENT

Basic Concepts related to Social Networks
Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree; network resilience; mixing patterns; degree correlations; community structures; network navigation.

Introduction to the Network Tools and Softwares
Pajek, UCINet, GraphViz and others.

Community Structure Analysis
Basic concepts of network communities, various community finding approaches like Girvan-Newman Algorithm, Spectral Bisection Algorithm, Radicchi Edge Clustering Algorithm (for binary as well as weighted graphs), Wu-Hubermann Algorithm, and Random Walk based Algorithm.

Random Graphs
Poisson random graphs, generalized random graphs, the configuration model, generating functions, power-law degree distribution, directed graph, bipartite graph, degree correlations.

Models of Network Growth
Price's model, Barabasi & Albert's model, other growth models, vertex copying models.

Processes taking place on Networks
Percolation theory and network resilience, Epidemiological processes.
Applications – search on networks, exhaustive network search, guided network search, network navigation; network visualization and semantic zooming.