Andrej Mrvar: Social Network Analysis with Pajek

This course covers general topics of network analysis. The emphasis is given to *visualization of networks* and *analysis of very large networks*.

Software

Program package for analysis and visualization of large networks – *Pajek*.
Pajek can be downloaded for free from http://pajek.imfm.si/

Course textbook

de Nooy, W., Mrvar, A., and Batagelj, V. (2011):
Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition. New York: Cambridge University Press.
http://www.cambridge.org/gb/knowledge/isbn/item6436521/Exploratory%20Social%20Network%20Analysis%20with%20Pajek/?site_locale=en_GB

The course assumes basic knowledge of mathematics and statistics and familiarity with at least one statistical package (SPSS or R).

Course outline

Definitions, network representations, program Pajek:

// Chapter 1

- graph and network (definition, representation (matrix, list of neighbours)
- types of networks (undirected, directed networks, acyclic networks, temporal networks, 2-mode networks, signed networks)
- size and density (small and large networks, sparse and dense networks)
- network visualization, automatic and manual layouts
- exporting visualization to other formats, e.g. 2D (EPS, SVG) and 3D (X3D, VRML, kinemage)
- starting with program Pajek

Introductory graph theory, basic notions:

// Chapter 2

walk, chain, path, closed walk, cycle, closed chain, loop, length and value of path, the shortest path, diameter, k-neighbour, depth of vertex in acyclic graph

Introductory network analysis:

// Chapters 3,7

Clusters, partitions, vectors, cut-outs, components (strong, weak, biconnected), cores and generalized cores, brokerage roles (coordinator, itinerant broker, representative, gatekeeper, liaison), triads, cliques, global and local views

Centrality measures and measures of prestige:

// Chapters 6, 9

- unit centrality measures (degree, closeness, betweenness centrality)
- network centralisation
- influence domain
- proximity prestige
- hubs and authorities

Analysis of two-mode networks:

// Chapter 5

- definition of two-mode networks
- indirect analysis of two mode networks: transforming two-mode networks to ordinary valued networks
- normalisations of obtained valued networks
- line islands
- direct analysis of two mode networks: blockmodeling

Signed graphs:

// Chapter 4

- definition of a signed graph
- balanced and partitionable signed graphs
- inconsistency (error) of given partition of vertices
- searching for optimal structural balance partitions using local optimisation
- relaxed structural balance

Analysis of very large networks, example genealogies:

// Chapter 11

- programs for entering kinship data
- representation of genealogies by graphs (Ore graph, p-graph and bipartite p-graph)
- advantages and disadvantages of the presentations
- analysis of genealogies (searching for relatives, predecessors, successors, relinking marriages)

Blockmodeling:

// Chapter 12

- introduction to blockmodeling
- equivalences (structural, regular equivalence, other types)
- determining blockmodels (indirect and direct approaches)