

Week 07

Community structure

Tuesday, October 4

INFO 5613: Network Science

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Agenda

- The presence of dense/cohesive interpersonal relations indicates a social group
- **Cliques/clans/cores** – different definitions of cohesive sub-groups in a network
- **Community detection** – algorithms for identifying sub-groups in a network
- **Block models** – a class of network models for generating or identifying subgroups
- Module Assignment 2: write a special call for network perspective on X in your research area
 - Due October 15
- Final assignment

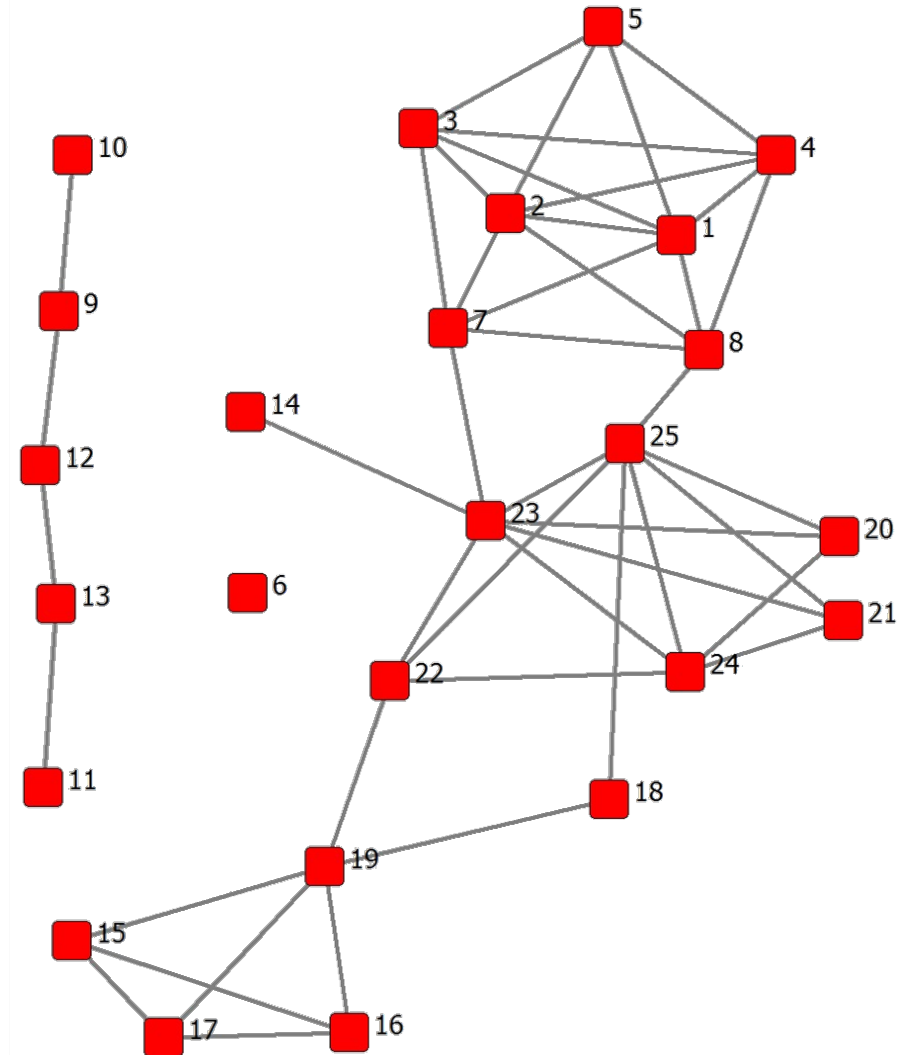
Discussion

- Theories of social cohesion, group structure, and community identification in network
- Readings
 - Friedkin, N. E. (2004). Social cohesion. *Annual Review of Sociology*, 30(1):409–425
 - Fortunato, S. and Hric, D. (2016). Community detection in networks: A user guide. *Physics Reports*, 659

Sub-group definitions

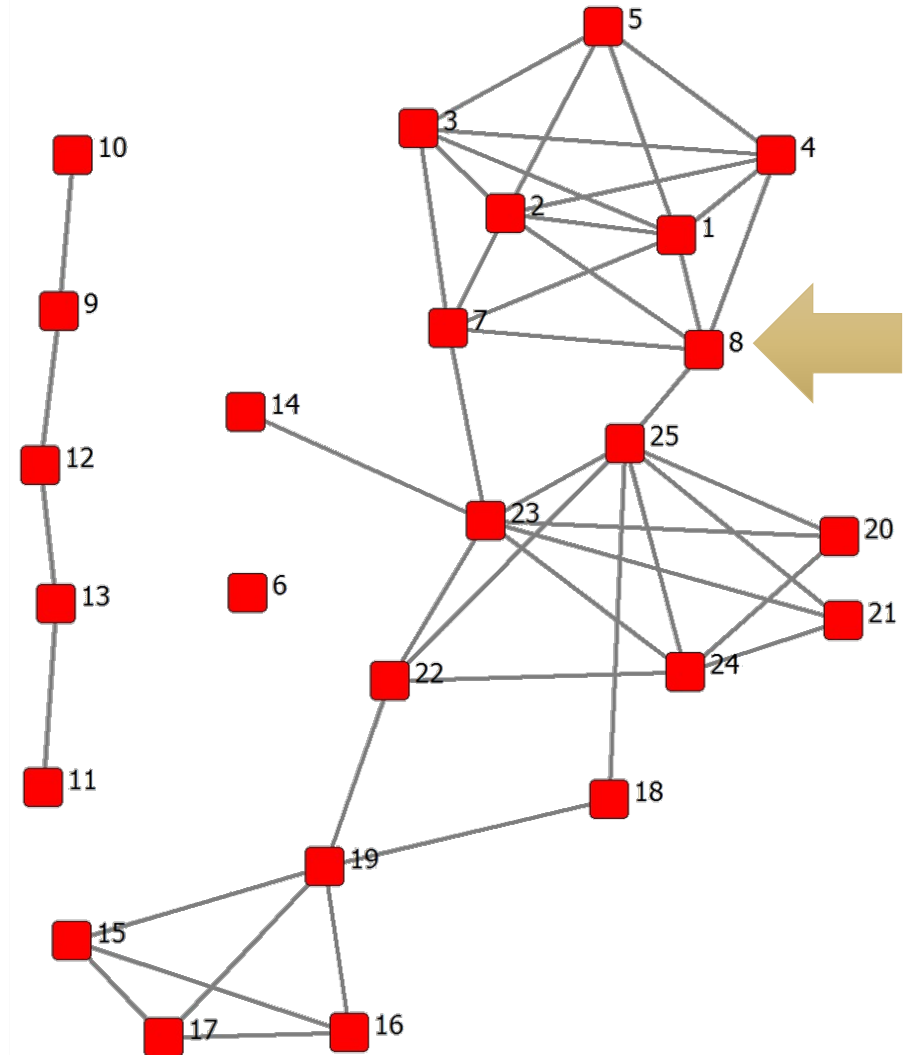
Identifying Clusters

- Component = all of the nodes connected by any number of steps.
- Giant component = largest component containing most of the nodes.



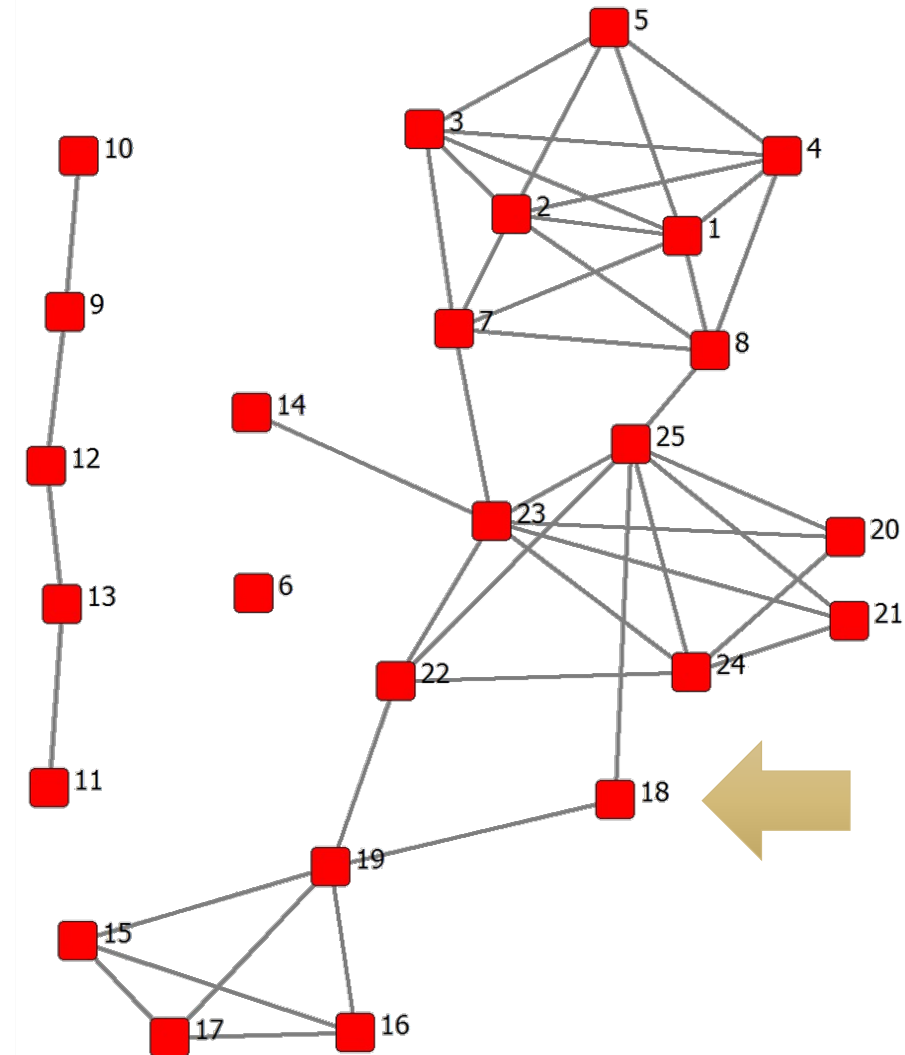
Cliques

- Largest subset of actors that are directly and completely connected to the rest of the set
- “Maximal complete sub-graph”
- 8 is a member of what cliques?



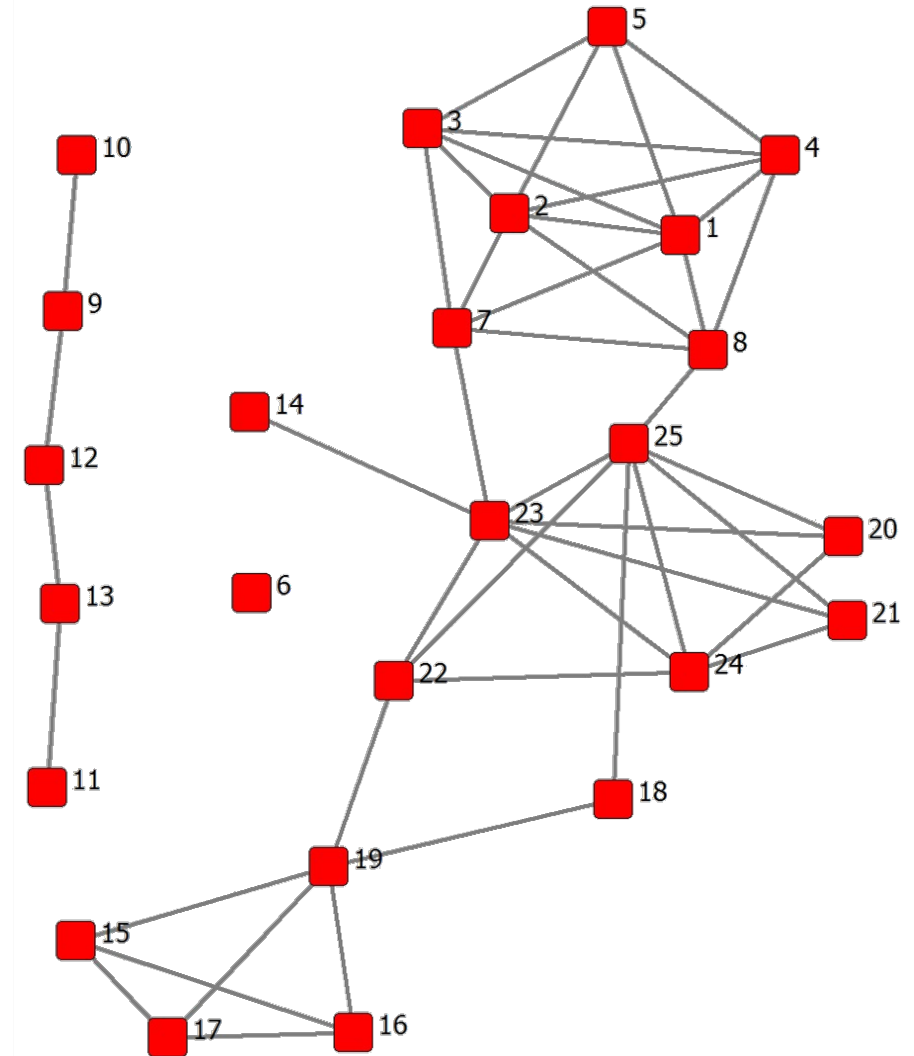
N-Cliques

- Largest subset of actors that are completely-connected with rest of the set ***within N steps***
 - N is typically 2
- Steps
 - For N=2, find all the alters and their alters
 - Eliminate any alters that are not connected in 2 or fewer steps.
- Useful for extracting network samples (seed + friends and friends of friends)
- 18 is a member of what 2-cliques?



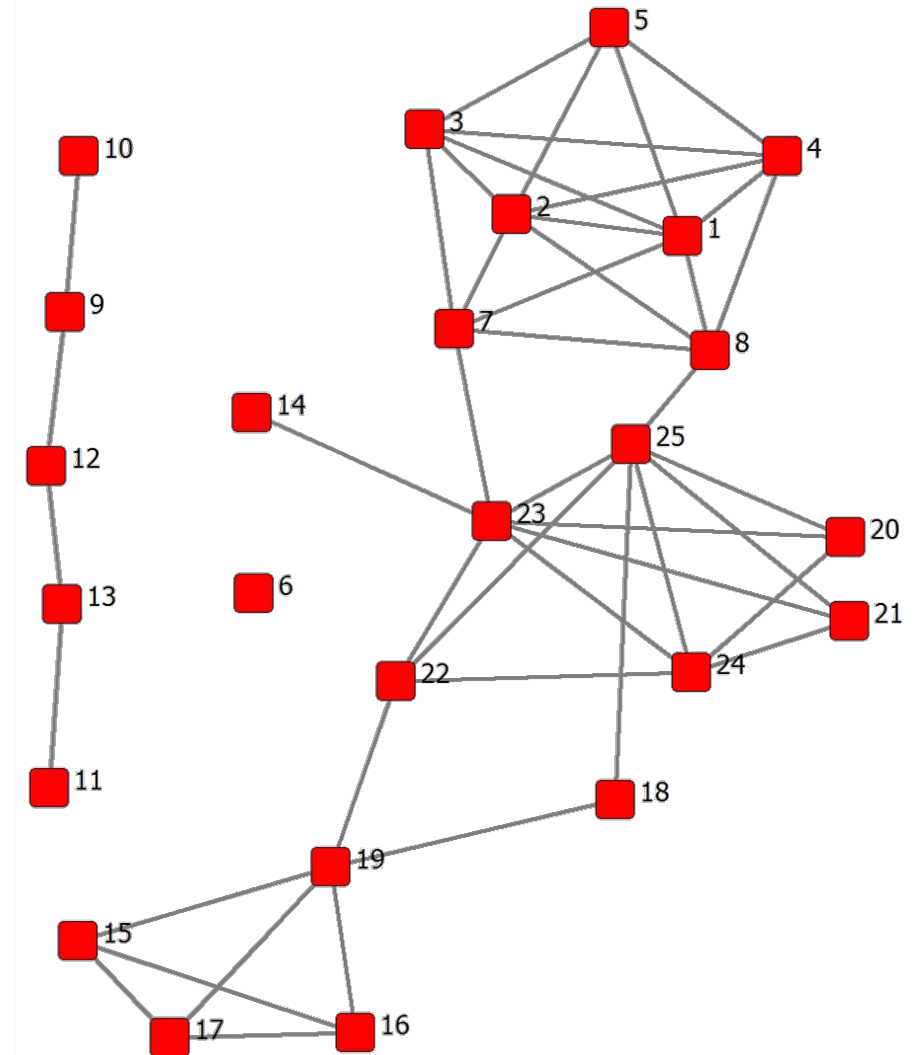
K-plexes

- Node is a member of a “clique” of size N if it has direct ties to $N-K$ members of that “clique”
 - A more forgiving definition of a clique.
- Steps
 - $N=4, K=2$: Look for groups of size 4
 - Eliminate those where all group members are not connected to at least $(4-2 = 2)$ other members of the group.
- Specifies the minimum number of connections that must be *present*
- Group members must have $N-K$ direct ties to other group members, no intermediaries
- $N=4, K=2?$



K-cores

- Maximal group of actors all connected to K other members of the group
 - Groups may feel well connected, even if some links are missing
- Allows for some ties to be *absent* from a group
- If an actor has some threshold of ties to a group, they may feel tied to the group even if they don't know all members
- What sets are 3-cores?



Community detection

- Jump into notebook

Module Assignment 2

Proposal for network perspectives on X

- Convening conversations are an important genre of scholarly writing
- Write up a (minimum) 1,000-word proposal on network perspectives for your research domain
- Outline
 - Motivate a gap in understanding and identify relevant network perspectives to explore it
 - Identify and summarize related work showcasing boundaries and opportunities
 - For a panel format, assemble your dream team of panelists and what each would speak about
 - For a workshop format, outline the activities that would happen among attendees
 - For a special issue format, enumerate themes you contributors could write on
 - Include logistics of deadlines, timelines, *etc.*
- Look to journals and conferences in your disciplines for examples
- Due Friday, October 15

Final assignment

What to do?

- Choose your own adventure!

Next class

Readings

- Week 7 – Community Structure: cohesion, cores/cliques/clans, community detection
- Readings
 - Friedkin, N. E. (2004). Social cohesion. *Annual Review of Sociology*, 30(1):409–425
 - Fortunato, S. and Hric, D. (2016). Community detection in networks. *Physics Reports*, 659:1–44