CSI 445/660 – Part 3
(Networks and their Surrounding Contexts)

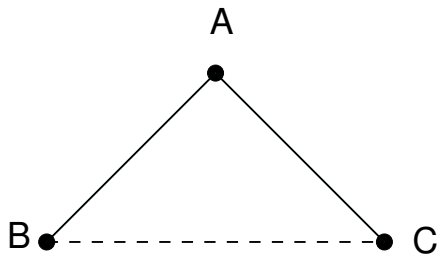
Ref: Chapter 4 of [Easley & Kleinberg].

External Factors Affecting Network Evolution

Homophily:

- A basic principle: "We tend to be similar to our friends".
- Governs the structure of social networks.
- Has a long history:
  - Socrates: "People love those who are like themselves".
  - Plato: "Similarity begets friendship".
  - Well known proverb: "Birds of a feather flock together".
- Provides an illustration of how the **surrounding context** drives the formation of networks.

Triadic Closure



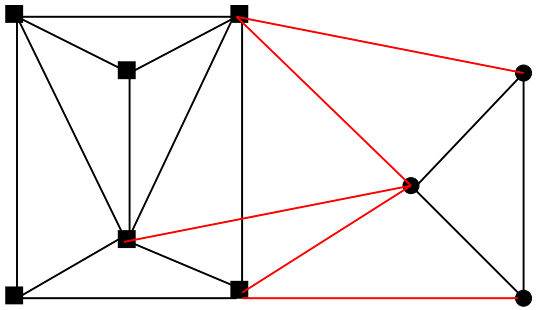
- Having a common friend is one reason for triadic closure.
- Homophily provides another reason.

- Suppose B and C are majors in the same department.
- They may become friends even though there is no common friend. (This is an effect of the surrounding context).

Measuring Homophily:

- A characteristic must be specified.
- **Examples:** Age, gender, ethnicity.
- How can we check whether a given network exhibits homophily with respect to a specified characteristic?

Measuring Homophily (continued)



- Friendship network of some children in an elementary school.
- Circles denote girls and squares denote boys.

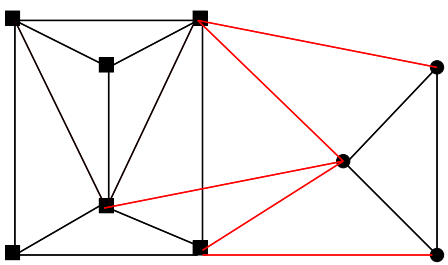
- We want to check whether this network exhibits **gender homophily**.
- **Extreme case of homophily:** The network does not have any "cross-gender edge" (i.e., an edge joining a boy and a girl). This is not typical.
- One can develop a numerical measure of homophily with respect to a characteristic.
- This will be illustrated using a characteristic (namely, gender) which has two possible values.

Description of the Method: See Handout 3.1.

Measuring Homophily (continued)

Homophily Test: Consider a network H with N_B boys and N_G girls. Let $p = N_B/(N_B + N_G)$ and $q = 1 - p = N_G/(N_B + N_G)$. If the fraction of cross edges in H is significantly below $2pq$, then there is evidence for gender homophily.

Example:



- Here, $N_B = 6$ and $N_G = 3$.
- Total number of edges $= 18$.
- No. of cross edges $= 5$.
- So, fraction of cross edges $= 5/18$.

- $p = N_B/(N_B + N_G) = 6/9 = 2/3$.
- $q = 1 - p = 1/3$.
- $2pq = 4/9 = 8/18$.
- Since the actual fraction of cross edges $(5/18)$ is less than the fraction $2pq$, we conclude that the network exhibits some degree of homophily.

Mechanisms Underlying Homophily

- Homophily is observed behavior.
- Sociologists want to understand the mechanisms that lead to homophily.
- Two known mechanisms are **selection** and **socialization**.

Selection:

- Applies to **immutable** characteristics (such as ethnicity or race).
- People "select" friends with similar characteristics.

Socialization or Social Influence:

- Applies to **mutable** characteristics (e.g. behaviors, interests, beliefs, opinions).
- People may modify their characteristics to align with the behaviors of their friends.