

HUDK 4050: CORE METHODS IN EDM

Formal & Informal Learning Analytics

Tomorrow

11am - GDH 449

(food)

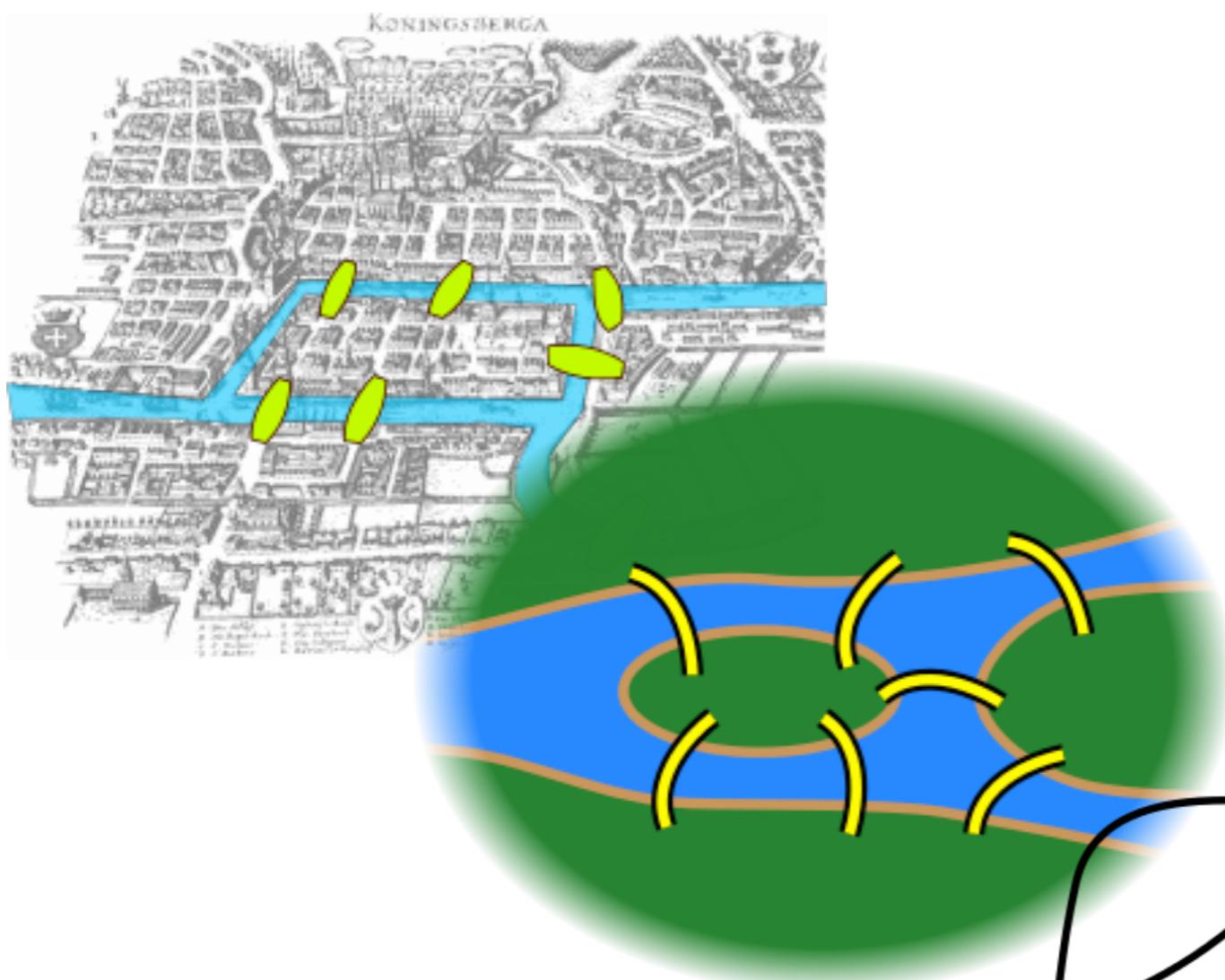
Class Experiment

Anna

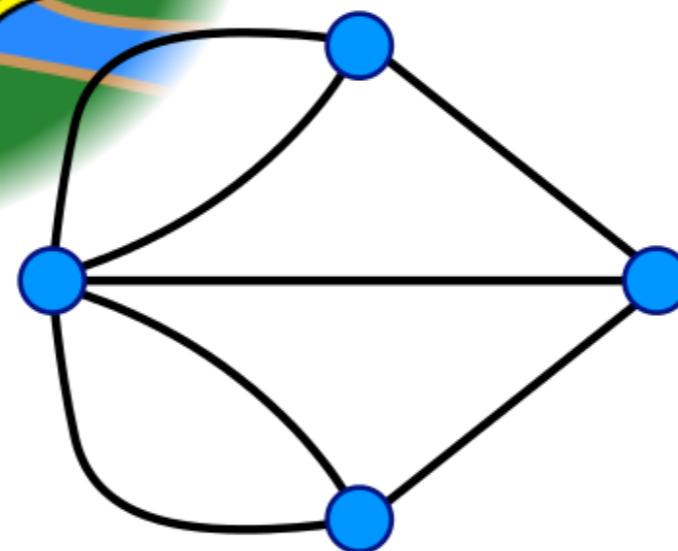
**[http://bit.ly/
HUDK405019SNA](http://bit.ly/HUDK405019SNA)**

Social Network Analysis

History

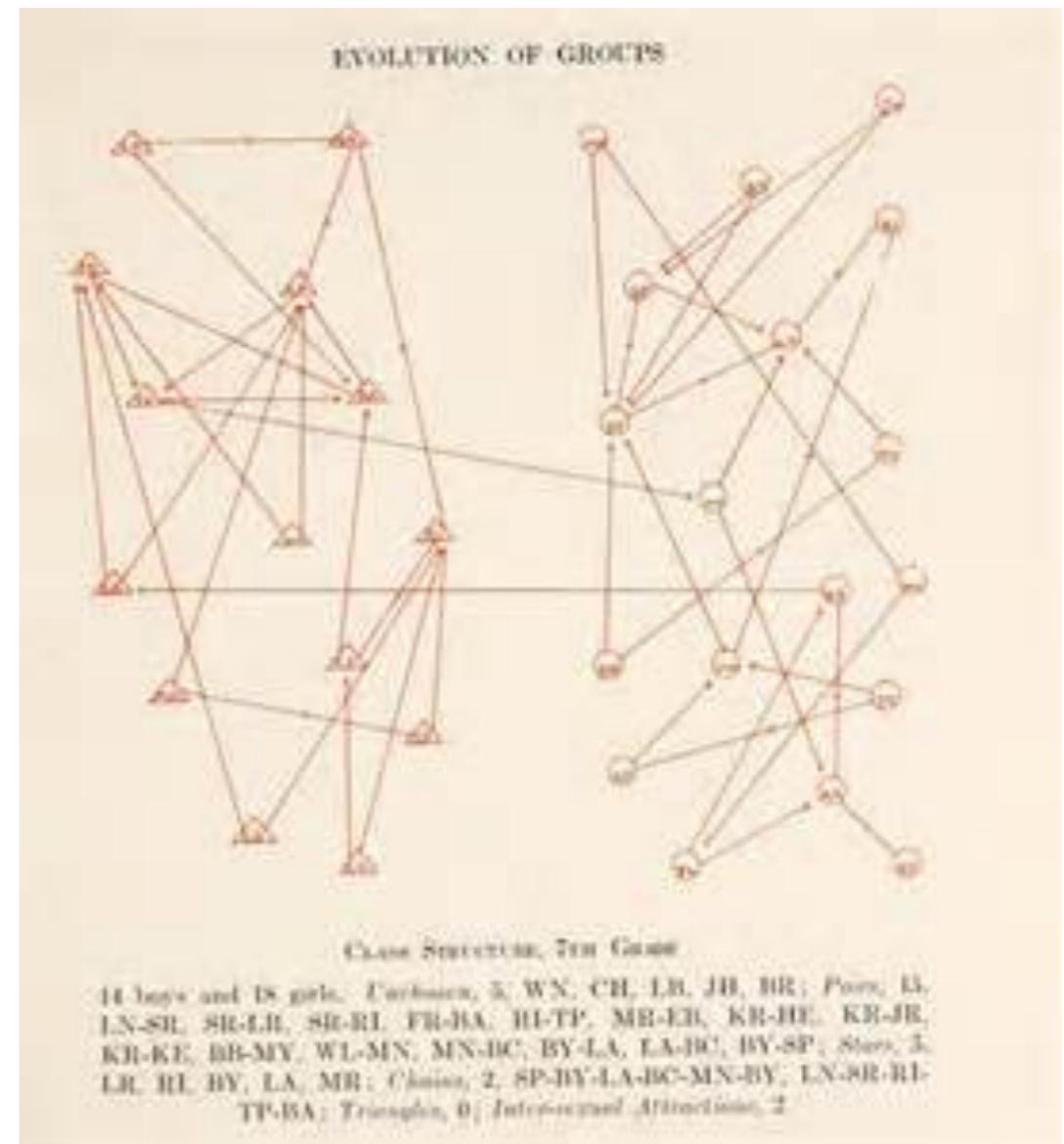


Leonhard Euler



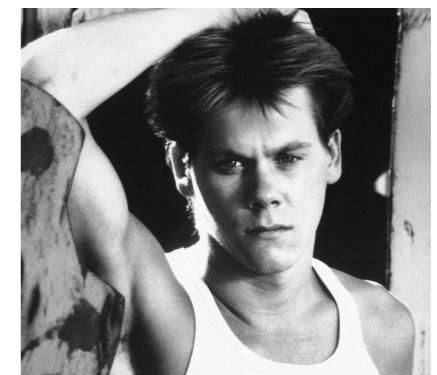
Use in Education

- Helen Jennings & Jacob Levy Moreno
- Hudson School for Girls (1934)



History

- Random network the size of the US (in 1950) would require at most two intermediaries to connect any two people (Kochen)
- Small World Experiments (Milgram)
 - Postcards sent to random people in Kansas
 - People instructed to send their postcard to a target person in Boston or someone that they think might know that person



Use in Education

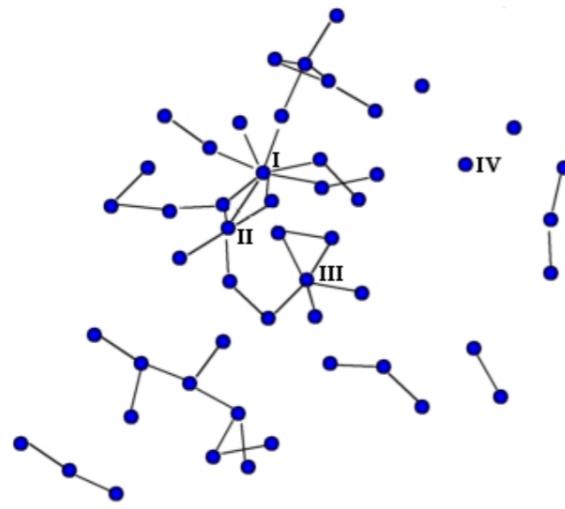


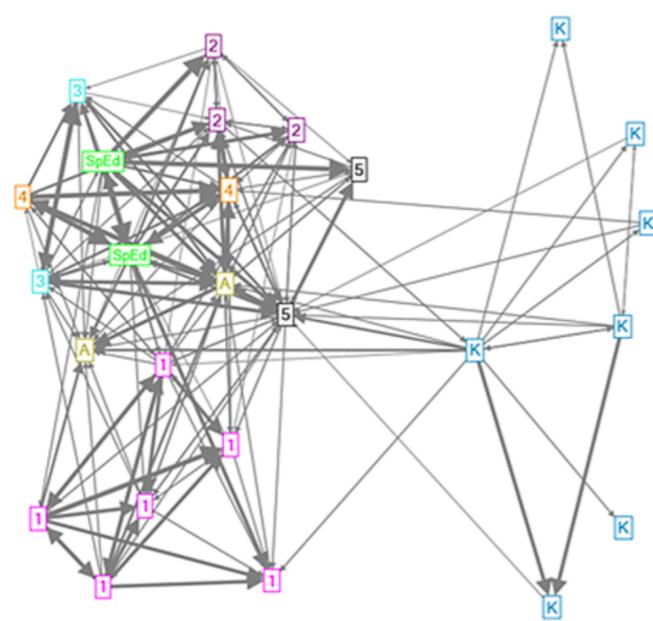
Figure 2. Sociogram of discussion forum interactions

Dawson (2008)

Centrality measures from forum posts correlate to student sense of belonging (mediated by external network)

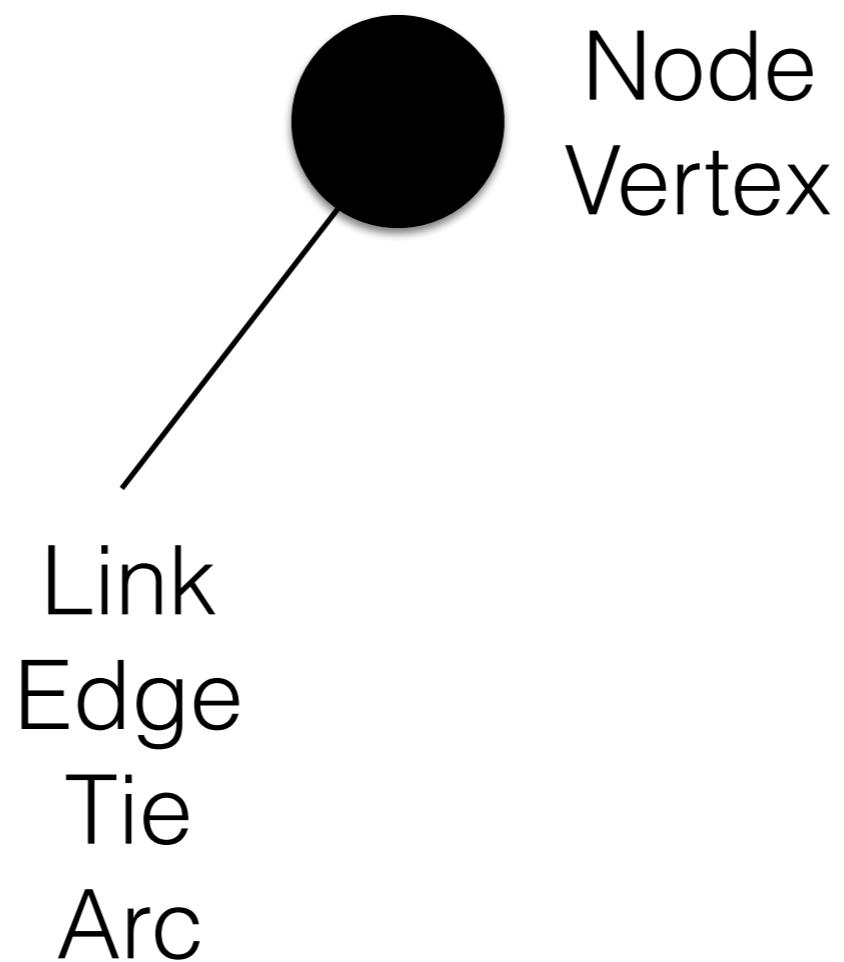
Smith, Trygstad, Hayes (2016)

SNA can be used to identify influential teachers within their peer group

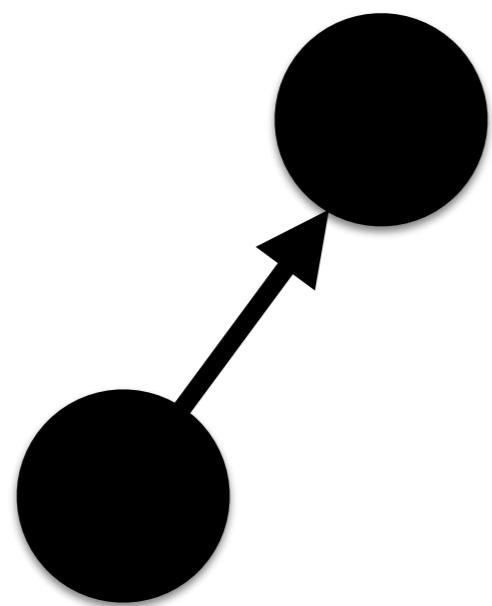


Networks

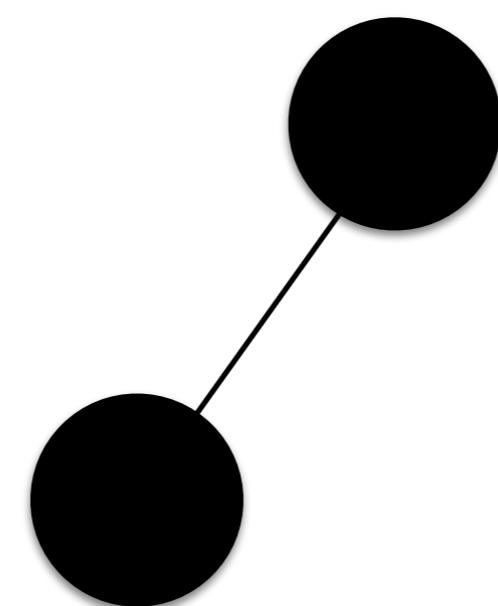
(Graphs)



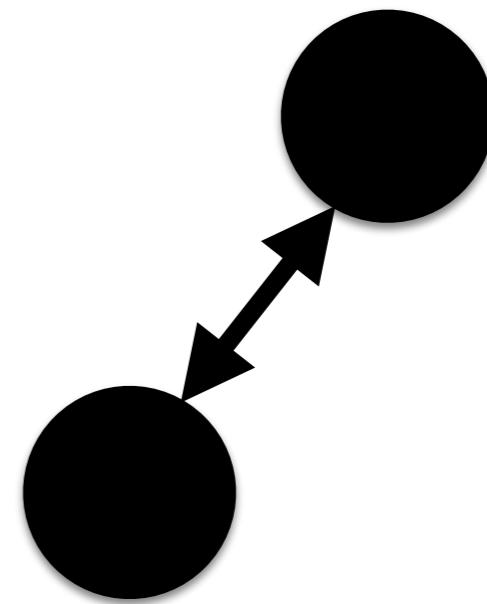
Networks



Directed



Undirected

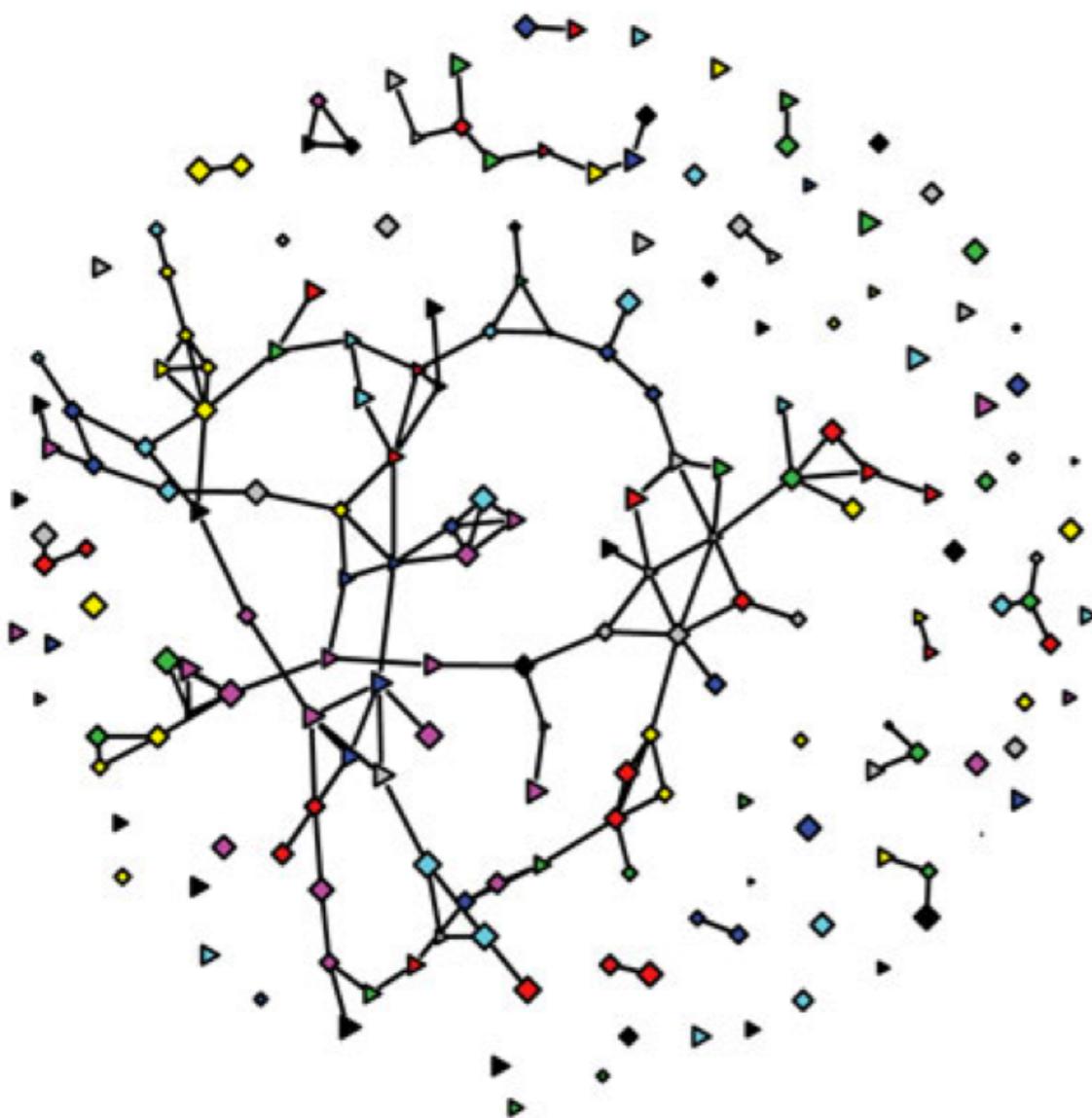


Reciprocal

Degree

The number of links to other nodes in the network

Undirected



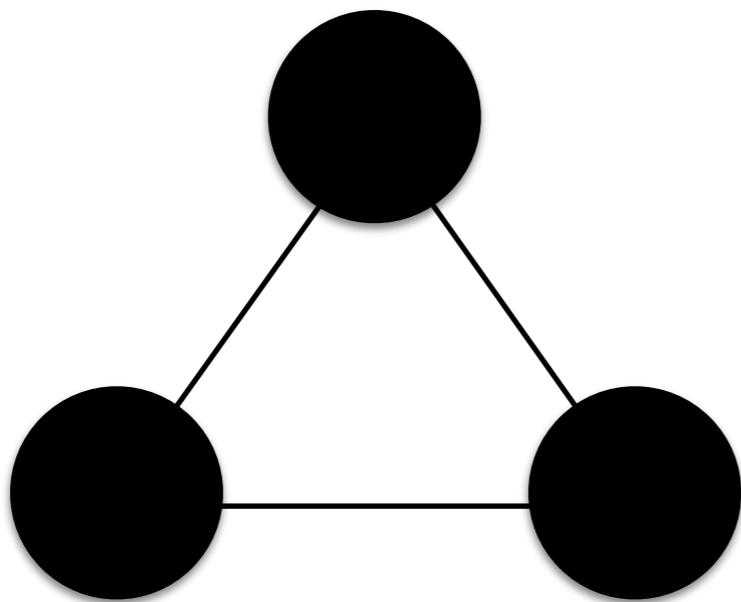
Directed



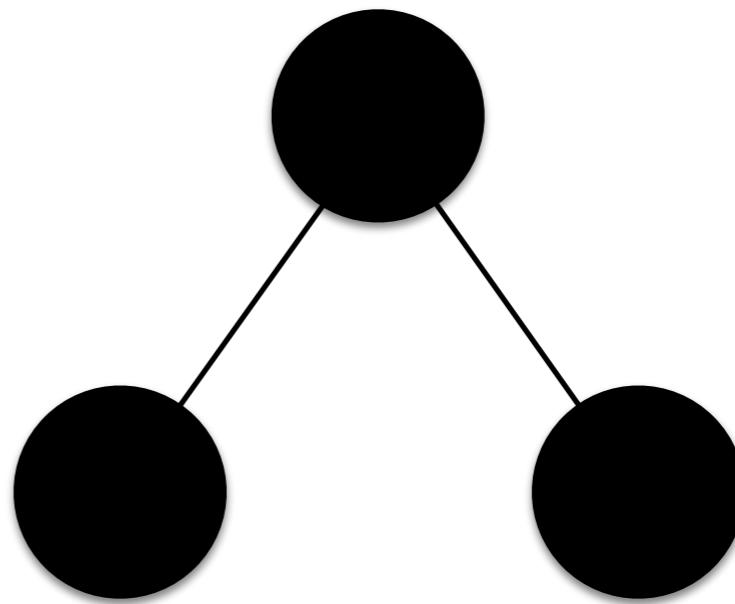
Indegree = Popularity
Outdegree = No shame

Density

How close is the graph to the maximal number of links



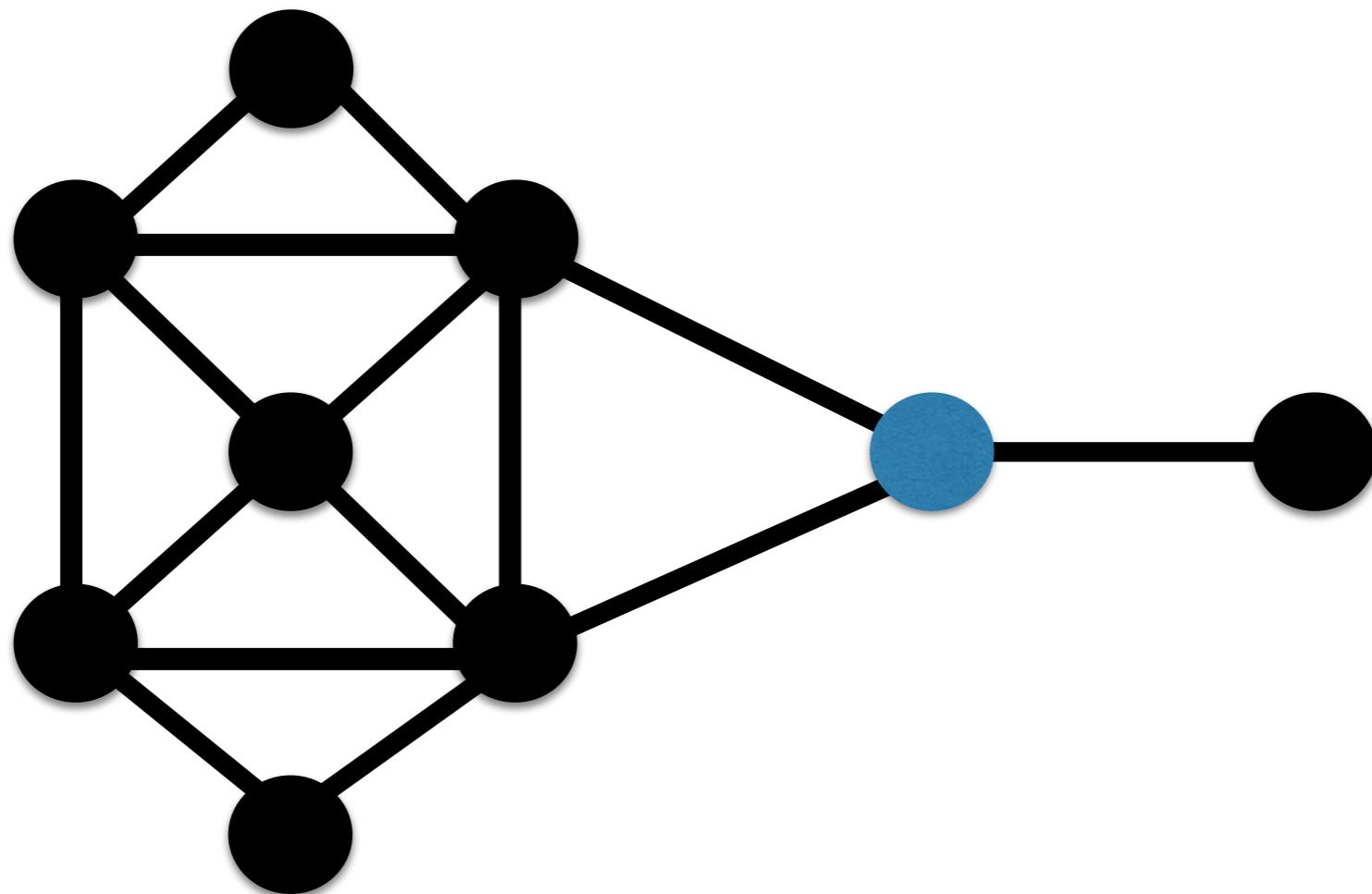
3 actual
3 possible
Density = 1



2 actual
3 possible
Density = 0.67

Betweenness Centrality

The extent to which a node lies between other nodes



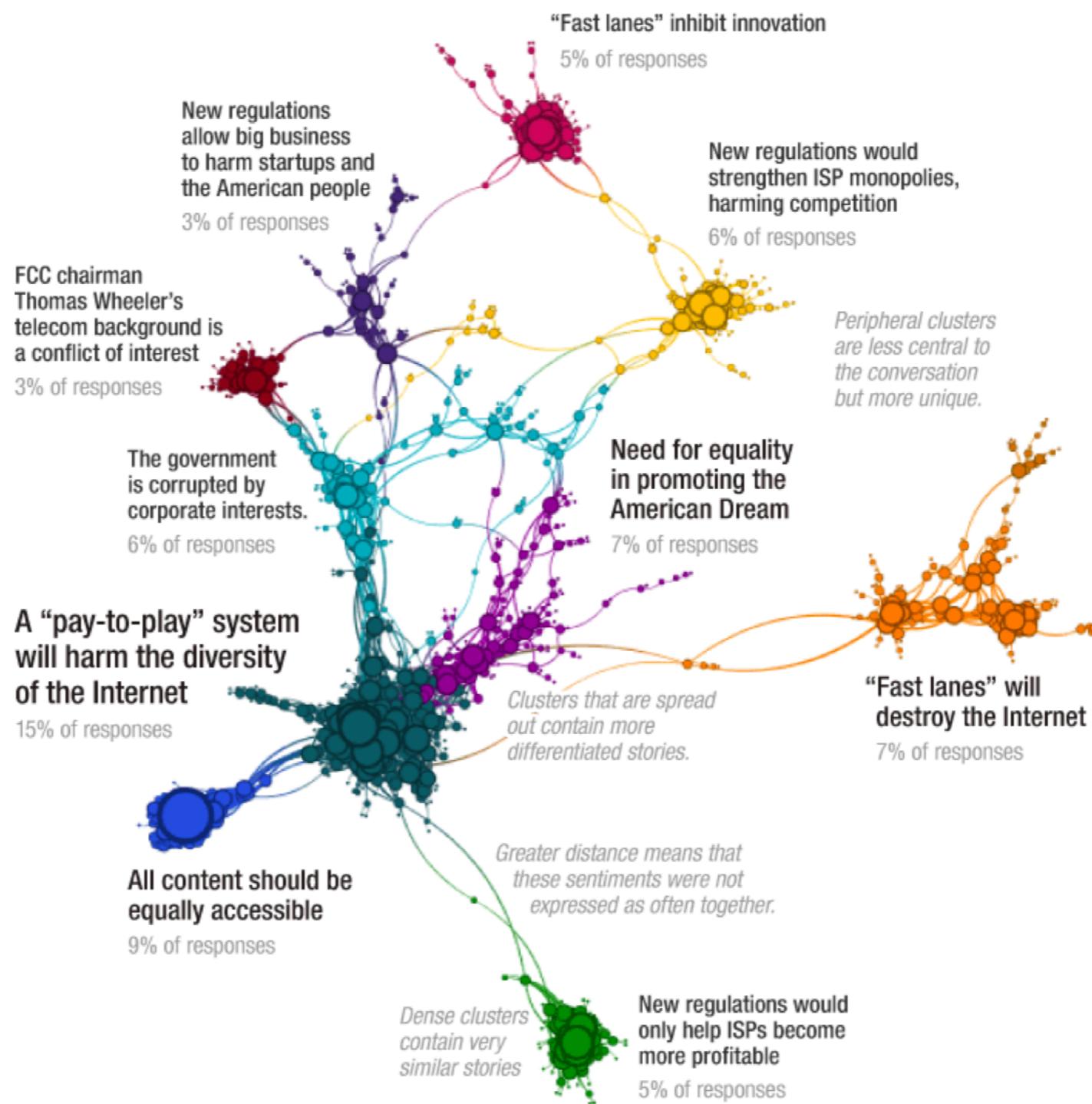
It is equal to the number of shortest paths from all nodes to all others that pass through that node

Modularity

The fraction of the edges that fall within the given groups minus the expected such fraction if edges were distributed at random

$$\begin{aligned} Q_S &= \frac{1}{2\bar{w}} \sum_i \sum_j \left(\bar{w}_{ij} - \frac{\bar{w}_i \bar{w}_j}{2\bar{w}} \right) \delta(C_i, C_j) \\ &= \frac{1}{4w} \sum_i \sum_j \left(w_{ij} + w_{ji} - \frac{(w_i^{\text{out}} + w_i^{\text{in}})(w_j^{\text{out}} + w_j^{\text{in}})}{4w} \right) \delta(C_i, C_j) \\ &= \frac{1}{4w} \sum_i \sum_j \left[\left(w_{ij} - \frac{w_i^{\text{out}} w_j^{\text{in}}}{2w} \right) + \left(w_{ji} - \frac{w_i^{\text{in}} w_j^{\text{out}}}{2w} \right) \right] \delta(C_i, C_j) \\ &= -\frac{1}{(4w)^2} \sum_i \sum_j (w_i^{\text{out}} - w_i^{\text{in}})(w_j^{\text{out}} - w_j^{\text{in}}) \delta(C_i, C_j) \\ &= Q_D - \frac{1}{(4w)^2} \sum_i \sum_j (w_i^{\text{out}} - w_i^{\text{in}})(w_j^{\text{out}} - w_j^{\text{in}}) \delta(C_i, C_j). \end{aligned}$$

How do we make the network look nice?



How do we make the network look nice?

Force directed graphing

- Attractive forces

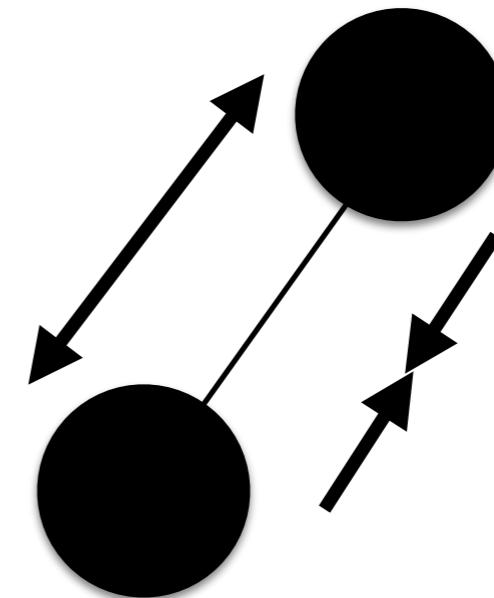
Springs

Hooke's Law: $F = kX$

- Repulsive forces

Electrons

Coulomb's Law: $|\mathbf{F}| = k_e \frac{|q_1 q_2|}{r^2}$



<https://youtu.be/YGDvR6CRwEc>

iGraph

<http://igraph.org/r/>

<https://igraph.org/r/doc/>