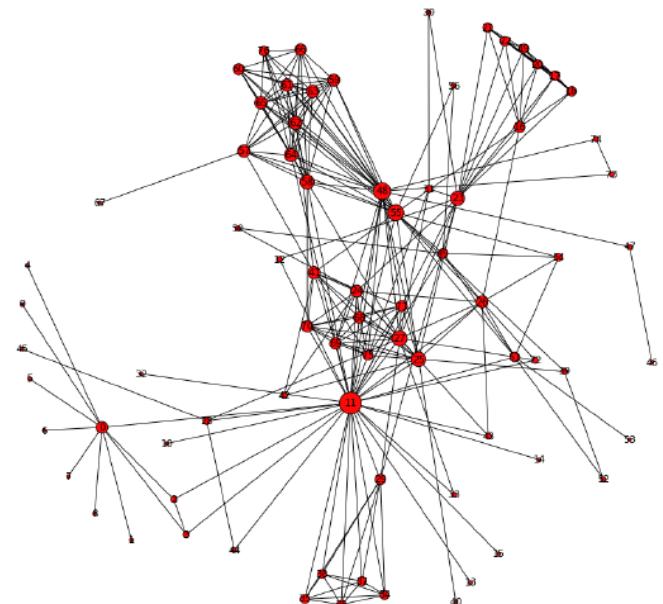


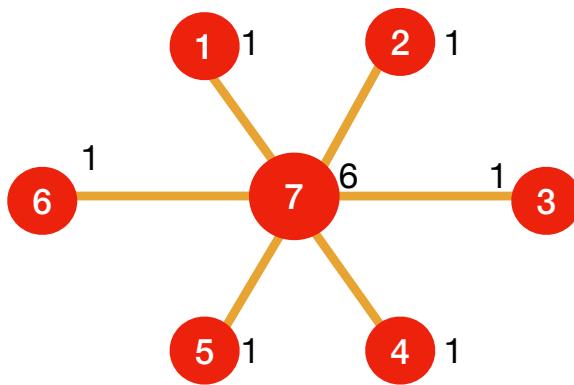
Network Analysis: Node centrality

Dr. Stanislav Sobolevsky

How important the node is for the network?

- detecting influential members of social networks
- strategy for efficient information dissemination
- web-search - important pages
- network resilience, detecting bottlenecks
- epidemic prevention and fighting

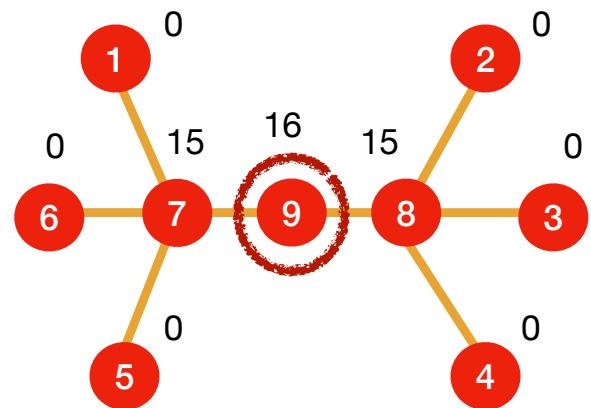




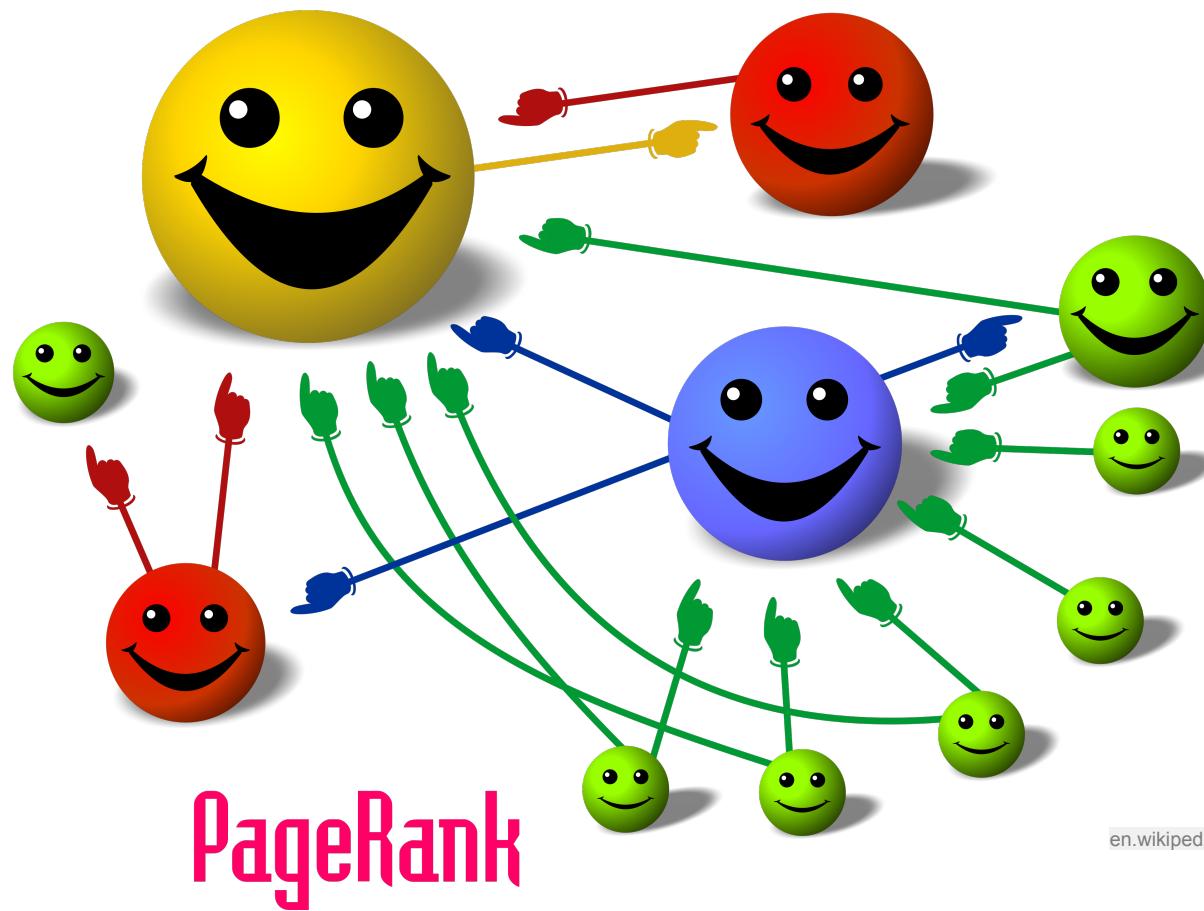
Closeness centrality

Bridges, brokerage between key parts

Betweenness centrality



Eigenvector and Pagerank Centrality



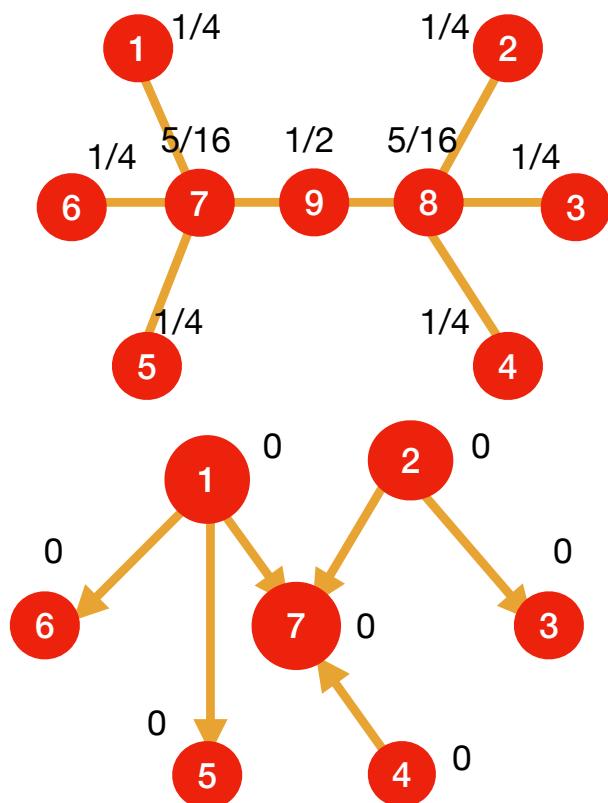


$$\text{centrality}(a) \sim \sum_{(a,b) \in E} \text{centrality}(b)$$

$$x \rightarrow Ax \rightarrow A^2x \rightarrow \dots A^jx$$

$$\lambda c = Ac \quad \lambda_j, e_j$$

$$\text{eigenvector_centrality}(a) = e_1$$



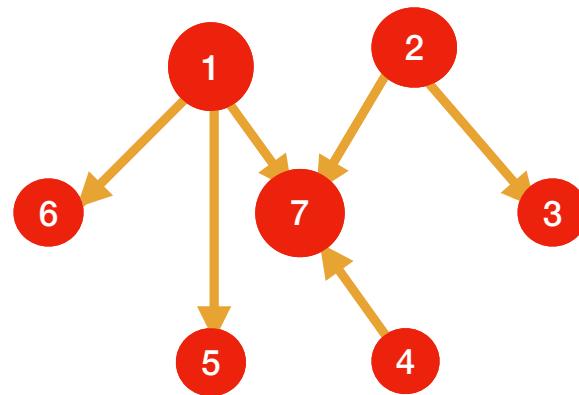


$$\text{centrality}(a) \sim \sum_{(a,b) \in E} \frac{\text{centrality}(b)}{\text{degree}(b)}$$

$$\text{pagerank}(a) = \alpha \sum_{(a,b) \in E} \frac{\text{pagerank}(b)}{\text{degree}(b)} + \frac{1 - \alpha}{n}$$

$$\text{pagerank}(a) = \alpha \sum_{(b,a) \in E} \frac{\text{pagerank}(b)}{\text{out_degree}(b)} + \frac{1 - \alpha}{n}$$

$$\alpha = 0.85$$



- ✓ Closeness
- ✓ Betweenness
- ✓ Eigenvector
- ✓ Pagerank