CS 519: Scientific Visualization Fall 2017
In-class Worksheet

Network Visualization Part 2

1. Network Metrics

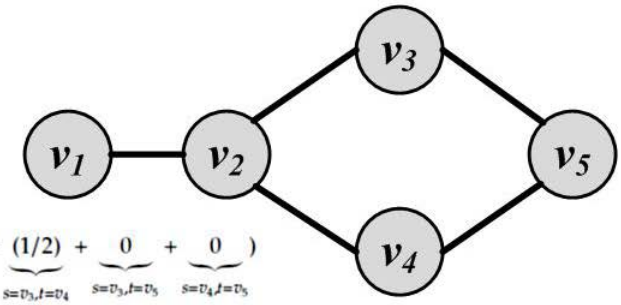
a. Betweeness Centrality can be calculated for nodes as well as edges.

The betweenness centrality of a node v is given by the expression:

$$g(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

where σ_{st} is the total number of shortest paths from node s to node t and $\sigma_{st}(v)$ is the number of those paths that pass through v.

Calculate nodal betweenness centrality for the graph shown here:



$$C_b(v_2) = 2 \times (\underbrace{(1/1)}_{s=v_1,t=v_3} + \underbrace{(1/1)}_{s=v_1,t=v_4} + \underbrace{(2/2)}_{s=v_1,t=v_5} + \underbrace{(1/2)}_{s=v_3,t=v_4} + \underbrace{0}_{s=v_3,t=v_5} + \underbrace{0}_{s=v_4,t=v_5})$$
$$= 2 \times 3.5 = 7,$$

$$C_b(v_3) = 2 \times (\underbrace{0}_{s=v_1,t=v_2} + \underbrace{0}_{s=v_1,t=v_4} + \underbrace{(1/2)}_{s=v_1,t=v_5} + \underbrace{0}_{s=v_2,t=v_4} + \underbrace{(1/2)}_{s=v_2,t=v_5} + \underbrace{0}_{s=v_4,t=v_5})$$
$$= 2 \times 1.0 = 2,$$

$$C_b(v_4) = C_b(v_3) = 2 \times 1.0 = 2,$$

$$C_b(v_5) = 2 \times (\underbrace{0}_{s=v_1,t=v_2} + \underbrace{0}_{s=v_1,t=v_3} + \underbrace{0}_{s=v_1,t=v_4} + \underbrace{0}_{s=v_2,t=v_3} + \underbrace{0}_{s=v_2,t=v_4} + \underbrace{(1/2)}_{s=v_3,t=v_4})$$
$$= 2 \times 0.5 = 1,$$

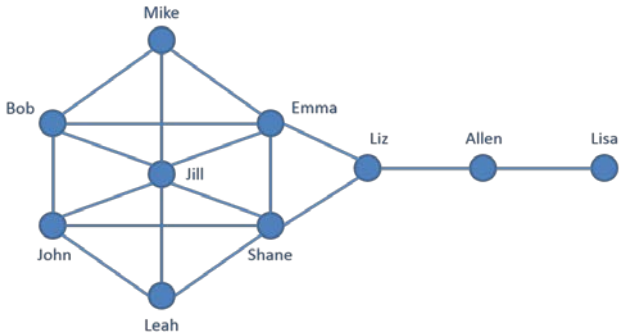
b. Can you imagine any other good metrics for determining importance of nodes or edges?

Nodal degree

Closeness Centrality $C(x) = \sum_y \frac{1}{d(x,y)}$

where d(x,y) is the shortest path distance between vertices x and y

2. Adjacency Matrix Representation



Create an adjacency matrix for the graph below.

	Mike	Bob	John	Leah	Shane	Liz	Emm	Jill	Allen	Lisa
Mike		■					■	■		
Bob	■		■				■	■		
John		■		■	■			■		
Leah			■		■			■		
Shane			■	■		■	■	■		
Liz					■		■		■	
Emma	■	■			■	■		■		
Jill	■	■	■	■	■		■			
Allen						■				■
Lisa									■	