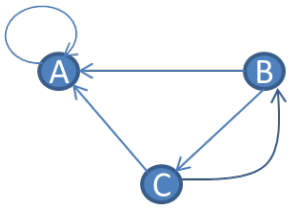
Name: _____ USC ID: _____

INF 553 – Spring 2018

Quiz 9: HITS algorithm (10 points), **15 minutes**

Consider again the following directed graph.



1. [2 points] Write the L and L^T matrices of the graph. Recall that L is the link/adjacency matrix of graph.

$$L: \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \qquad L^T: \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

2. [6 points] Assume that the initial hub scores of nodes, represented in a vector h^0, are all 1's. Derive a^0, h^1, a^1. Note "**a**" denotes the authority vector. Make sure vectors are normalized.

$$h^0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \qquad a^0 = L^T h^0 = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1/3 \\ 1/3 \end{bmatrix}$$

$$h^1 = L\, a^0 = \begin{bmatrix} 1 \\ 4/3 \\ 4/3 \end{bmatrix} = \begin{bmatrix} 3/4 \\ 1 \\ 1 \end{bmatrix}$$

$$a^1 = L^T h^1 = \begin{bmatrix} 11/4 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 4/11 \\ 4/11 \end{bmatrix}$$

3. [2 points] Does the above graph have a spider trap? If yes, explain what it is and whether it will absorb all the authority scores (that is, the authority score of all other nodes will be zero).

Yes, it has a spider trap.
No, it will not absorb all the authority scores. The authority of A is first used to compute the hub scores of B and C, which are then used to recompute the authority of A. In other words, the authority of A can in a sense flow out of A. Thus, not trapped.