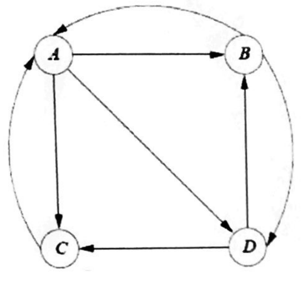
Quiz: Link Analysis

Name: ______________________ ID: ____________________

1) (2pts) What is the transition matrix for the graph below? What is the compact representation of this matrix (using the method described in class and in textbook)?



transition matrix (1pt) compact representation (1pt)

$$\begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 0 & \frac{1}{2} & 1 & 0 \\ \frac{1}{3} & 0 & 0 & \frac{1}{2} \\ \frac{1}{3} & 0 & 0 & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{2} & 0 & 0 \end{bmatrix} \end{array}$$

start_node	degree	Destination_node
A	3	{B, C, D}
B	2	{A, D}
C	1	{A}
D	2	{B, C}

2) (2pts) Using power iteration to calculate the PageRank, what is v^1 for the graph in questions 1 (v^0 is the initial vector)?

$$V' = \begin{bmatrix} \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \end{bmatrix}$$

$$V_1 = M \cdot V_0 = \begin{bmatrix} 0 & \frac{1}{2} & 1 & 0 \\ \frac{1}{3} & 0 & 0 & \frac{1}{2} \\ \frac{1}{3} & 0 & 0 & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{2} & 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \end{bmatrix} = \begin{bmatrix} \frac{3}{8} \\ \frac{5}{24} \\ \frac{5}{24} \\ \frac{5}{24} \end{bmatrix} \text{(1pt)}$$

(1pt)

3) (2pts) Using power iteration to calculate the PageRank with 20% tax, what is v^1 for the graph in questions 1 (v^0 is the initial vector)?

$$V' = \beta M \cdot V^0 + (1-\beta) V^0 = 0.8 \begin{bmatrix} 8/3 \\ 5/24 \\ 5/24 \\ 5/24 \end{bmatrix} + 0.2 \begin{bmatrix} 1/4 \\ 1/4 \\ 1/4 \\ 1/4 \end{bmatrix} = \begin{bmatrix} 7/20 \\ 13/60 \\ 13/60 \\ 13/60 \end{bmatrix}$$

4) (2pt) What is the stationary distribution for random walks described in class? How do we use the property of stationary distribution to find the page ranks?

The Rank Vector (which satisfies $P(t+1) = M p(t) = p(t)$) (1pt)

(1pt) Gaussian elimination and power iteration. We can also use the Eigen vector of M to find page ranks.

5) (1pt) How do we overcome spider traps in calculating page ranks in class? Why does it work?

Teleports (taxation). (0.5pt)

Because it gives chance to jump to any links. and make the graph strongly connected. (0.5pt)

6) (1pt) How do we use prune and propagate to overcome dead ends in calculating page ranks in class?

Refer to Slide "Linkanalysis" Page 76.