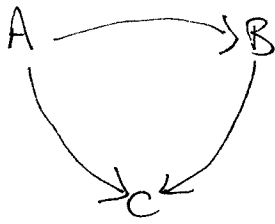


# Web Page Graph



Calculate PageRank and Hub+Authority Scores.

## 1. PageRank

Step 1. Create an Adjacency Matrix of the pages/links.

	A	B	C
A	0	1	1
B	0	0	1
C	0	0	0

← C has no outbound links, so must teleport,  
So apply  $1/N$  to each C component.

	A	B	C
A	0	1	1
B	0	0	1
C	$1/3$	$1/3$	$1/3$

Given: teleport probability of 0.15  $\rightarrow \alpha = 0.15$ .

$$So, P = \frac{0.85 \cdot Pr}{(1-\alpha)} + \frac{0.15 \cdot 1/3}{(\alpha) (1/N)}$$

$Pr$  = Probability of teleporting to a particular page:

$$Pr = \begin{bmatrix} 0 & 1/2 & 1/2 \\ 0 & 0 & 1/1 \\ 1/3 & 1/3 & 1/3 \end{bmatrix} = \begin{bmatrix} 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \end{bmatrix}$$

Then apply  $\alpha$ -formula to all but the last row:

$$P = \begin{bmatrix} 0.05 & 0.48 & 0.48 \\ 0.05 & 0.05 & 0.9 \\ 0.33 & 0.33 & 0.33 \end{bmatrix}$$

Next, iterate w/ 'Power Method'

Choose a vector :

$$\vec{X}_0 = (1, 0, 0)$$

$$\vec{X}_1 = \vec{X}_0 \cdot P = (1, 0, 0) \begin{pmatrix} 0.05 & 0.48 & 0.48 \\ 0.05 & 0.05 & 0.9 \\ 0.33 & 0.33 & 0.33 \end{pmatrix} = (0.05, 0.48, 0.48)$$

$$\vec{X}_2 = \vec{X}_1 \cdot P = (0.05, 0.48, 0.48) \begin{pmatrix} 0.05 & 0.48 & 0.48 \\ 0.05 & 0.05 & 0.9 \\ 0.33 & 0.33 & 0.33 \end{pmatrix}$$

$$= \begin{pmatrix} (0.05)(0.05) + (0.48)(0.05) + (0.48)(0.33), \\ (0.48)(0.48) + (0.48)(0.05) + (0.48)(0.33), \\ (0.48)(0.48) + (0.48)(0.9) + (0.48)(0.33) \end{pmatrix} = \begin{matrix} A & B & C \\ (0.18, & 0.413, & 0.82) \end{matrix}$$

So, after 2 iterations, PageRanks are :

$$A : 0.18$$

$$B : 0.413$$

$$C : 0.82$$