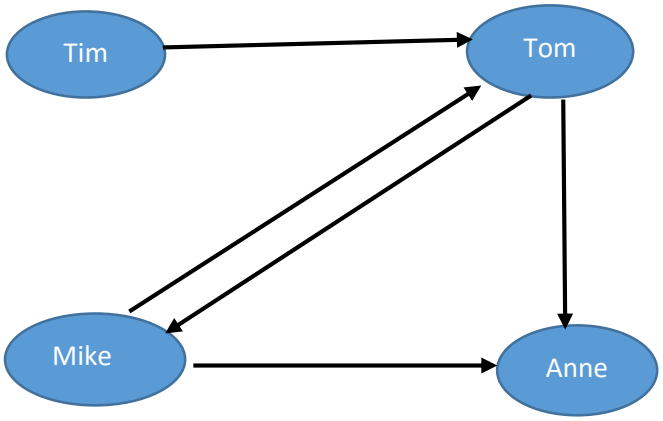
Homework Assignment 7

The page rank graph for the above tweets with users as nodes and connection represented by the nodes between the users can be drawn as follows.



The figure shows the page rank graph which represents the 4 tweets mentioned above. Tom mentions Tim and Anne in his tweets hence an edge from Tom to Tim and Anne is drawn.

From the above graph we can construct the transition or connection matrix **M** as shown below

Users	Tim	Mike	Tom	Anne
Tim	0	0	0	0
Mike	0	0	½	0
Tom	1	½	0	0
Anne	0	½	½	0

The above matrix M can be formed by the page rank of user divided by the number of outing links between the users. For example, in the above case the value for Tom -> Mike is ½ as Mike has 2 outgoing links and so diving the total rank by number of outgoing links we get ½.

The matrix is **substochastic** because the sum of values in column 4 is 0.This implies that node with label **Anne** is a **dead node.** Hence to compensate for it we modify the matrix **M**.

0	0	0	¼
0	0	½	¼
1	½	0	¼
0	½	½	¼

To manage the dead node we have to use **teleport,** which allows jump to a random node in case of a dead node rather than following an out link on the page. This can be implemented by changing the page rank vector repeating the same process of calculating new ranks from old rank.

$A= \beta*M + (1-\beta)*[1/N]_{N*N}$

$r_{new} = A * r_{old}$

In the above formula **(1-β)** represents the **probability of teleporting**. The given probability of teleporting is 0.1.Hence **β =0.9**, $[1/N]_{N*N}$ represents a N*N matrix where **N** is the **number of**

Nodes in the page graph.

¼	¼	¼	¼
¼	¼	¼	¼
¼	¼	¼	¼
¼	¼	¼	¼

Iteration 1:

β* M= 0.9 *

0	0	0	¼
0	0	½	¼
1	½	0	¼
0	½	½	¼

=

0	0	0	0.225
0	0	0.45	0.225
0.9	0.45	0	0.225
0	0.45	0.45	0.225

$(1 – \beta) * [1/N]_{N*N} = 0.1 *$

¼	¼	¼	¼
¼	¼	¼	¼
¼	¼	¼	¼
¼	¼	¼	¼

=

0.025	0.025	0.025	0.025
0.025	0.025	0.025	0.025
0.025	0.025	0.025	0.025
0.025	0.025	0.025	0.025

$A = \beta * M + (1 - \beta) * [1/N]_{N*N}$

=

0.025	0.025	0.025	0.25
0.025	0.025	0.475	0.25
0.925	0.475	0.025	0.25
0.025	0.475	0.475	0.25

$r_{new} = A *$ (Initially we assume that all node have same rank)

¼
¼
¼
¼

=

0.081
0.193
0.418
0.306

Iteration 2:

The value of A s taken from Iteration 1

$r_{new} = A * r_{old}$

0.025	0.025	0.025	0.25
0.025	0.025	0.475	0.25
0.925	0.475	0.025	0.25
0.025	0.475	0.475	0.25

*

0.081
0.193
0.418
0.306

=

0.093
0.278
0.253
0.364

Iteration 3:

The value of A s taken from Iteration 1

$r_{new} = A * r_{old}$

=

0.025	0.025	0.025	0.25
0.025	0.025	0.475	0.25
0.925	0.475	0.025	0.25
0.025	0.475	0.475	0.25

*

0.093
0.278
0.253
0.364

=

0.106
0.220
0.316
0.346

Users	Page Rank
Tim	0.106
Mike	0.220
Tom	0.316
Anne	0.346

Conclusion: The above result shows that Anne has the highest page rank. The page rank for users can be arranged as follows:

Anne > Tom > Mike > Tim.