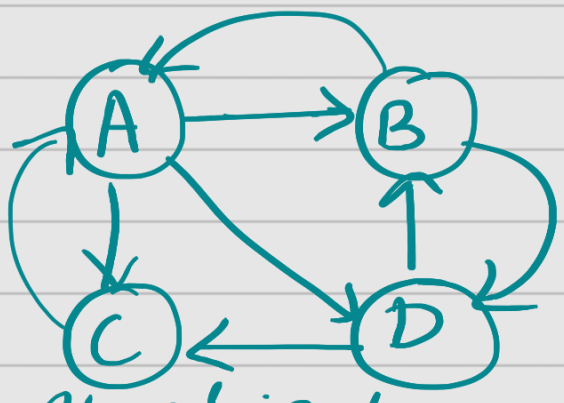
Big Data Analysis Assignment Page Rank and CPM

Data Analysis (University of Delhi)

BDA ASSIGNMENT

24.9.21

Q1) 

i) SIMPLIFIED

⊛ Iteration 1

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

$$V_0 = \begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} = \begin{bmatrix} 1/4 \\ 1/4 \\ 1/4 \\ 1/4 \end{bmatrix}$$

$$M \cdot V_0 = \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1/4 \\ 1/4 \\ 1/4 \\ 1/4 \end{bmatrix}$$

$$= \begin{bmatrix} 3/8 \\ 5/24 \\ 5/24 \\ 5/24 \end{bmatrix}$$

$$V1 = \begin{bmatrix} 3/8 \\ 5/24 \\ 5/24 \\ 5/24 \end{bmatrix}$$

(*) Iteration 2

$$M\,V1 = \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} \begin{bmatrix} 3/8 \\ 5/24 \\ 5/24 \\ 5/24 \end{bmatrix}$$

$$V2 = \begin{bmatrix} 15/48 \\ 11/48 \\ 11/48 \\ 11/48 \end{bmatrix} = \begin{bmatrix} 5/16 \\ 11/48 \\ 11/48 \\ 11/48 \end{bmatrix}$$

ii> MODIFIED

$$M_0 = \beta M + (1-\beta)\begin{bmatrix} 1 \\ N \end{bmatrix}$$

$$\beta = 0.8$$

$$M_0 = 0.8 \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} + 0.2 \begin{bmatrix} 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \end{bmatrix}$$

$$= \begin{bmatrix} 1/20 & 9/20 & 17/20 & 1/20 \\ 19/20 & 1/20 & 1/20 & 9/20 \\ 19/60 & 1/20 & 1/20 & 9/20 \\ 19/60 & 9/20 & 1/20 & 1/20 \end{bmatrix}$$

⊛ Iteration 1

$$V_1 = M_0 V_0$$

$$= \begin{bmatrix} 1/20 & 9/20 & 17/20 & 1/20 \\ 19/60 & 1/20 & 1/20 & 9/20 \\ 19/60 & 1/20 & 1/20 & 9/20 \\ 19/60 & 9/20 & 1/20 & 1/20 \end{bmatrix} \begin{bmatrix} 1/4 \\ 1/4 \\ 1/4 \\ 1/4 \end{bmatrix}$$

$$= \begin{bmatrix} 1/20 \\ 13/60 \\ 13/60 \\ 13/60 \end{bmatrix}$$

⊛ Iteration 2

$$V_2 = M_0 V_1$$

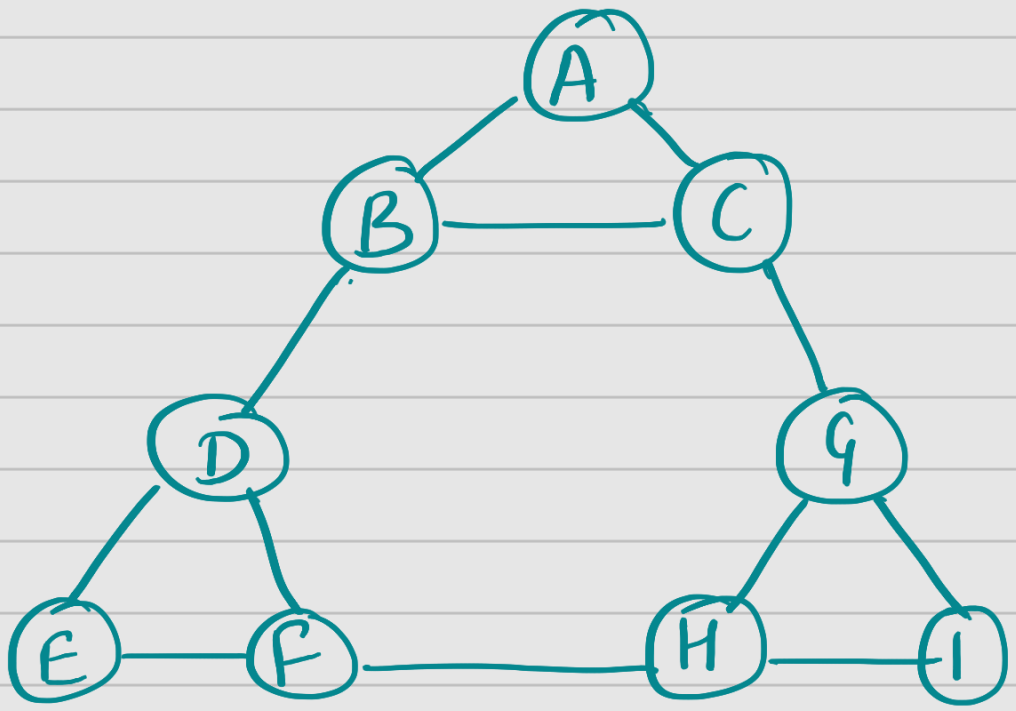
$$= \begin{bmatrix} 1/20 & 9/20 & 17/20 & 1/20 \\ 19/60 & 1/20 & 1/20 & 9/20 \\ 19/60 & 1/20 & 1/20 & 9/20 \\ 19/60 & 9/20 & 1/20 & 1/20 \end{bmatrix} \begin{bmatrix} 1/20 \\ 13/60 \\ 13/60 \\ 13/60 \end{bmatrix}$$

$$= \begin{bmatrix} 31/100 \\ 23/100 \\ 23/100 \\ 23/100 \end{bmatrix}$$

Q2)

	OTQ	CONT	PRED	ADH
Stock Market	SOMETIMES	✓	✓	SOMETIMES
Twitter Posts	SOMETIMES	✓	✓	SOMETIMES
Call Details Records	✓			✓
Emails	✓			✓
Blogging		✓		✓
Sensor Network		✓	✓	
Chandrayan 2	✓			✓

Q3) CPM



let R=3

i) Finding cliques of size 3

{A, B, C}, {D, E, F}, {G, H, I}

ii) Clique graph (No common vertices)

iii) Communities (No adjacent cliques)

{A, B, C}

{D, E, F}

{G, H, I}