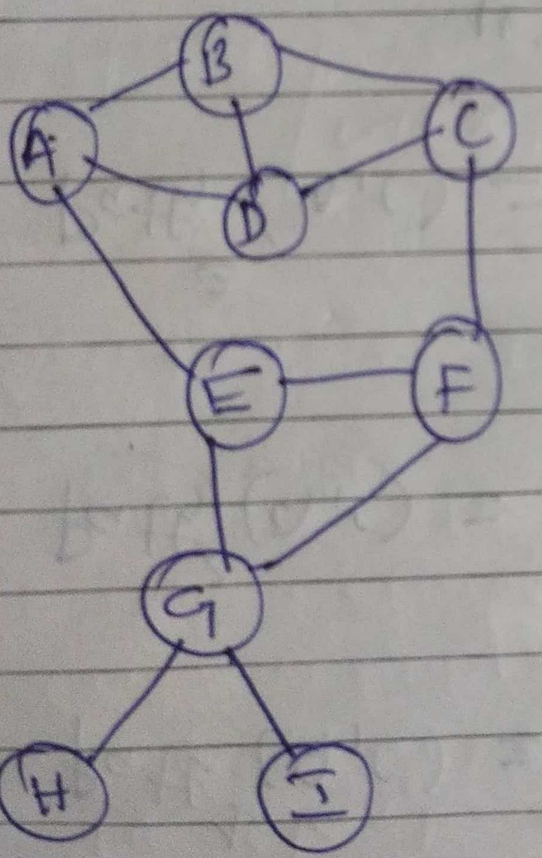
From the desk of : Katz Index Date:

$$Katz(x,y) = \sum_{l=1}^{\infty} \beta^{l} \cdot \left| path^{l}_{(x,y)} \right|$$

$$= \beta A + \beta^{2} A^{2} + \beta^{3} A^{3} + \cdots$$

where $path^{l}_{(x,y)} \rightarrow$ no. of l length paths from x to y and $\beta > 0$



If we want to find the likelihood of connection with A & C we find Katz(A,C)

β is a randomly choosen value, here $\beta = 0.5$

$path^{l}_{(x,y)}$ l length paths from x to y

similarly, we will look for $Path^{l}_{(A,C)}$

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$path^0(A,C) = 0$, no zero length paths between A & C

$path^1(A,C) = 0$ No one length paths between A & C

$Path^2(A,C) = 2$ two length paths between A & C
i.e. ABC, ADC

$Path^3(A,C) = 3$ three 3 length paths betwee A & C
i.e. ABDC, ADBC, AEFC

(we may look for $path^4(A,C)$, but it is always advisable to use short paths and that too mostly via common neighbours. therefore not going for $path^4(A,C)$)

$\therefore$ $Katz(A,C) = (0.5)^1 \times 0 + (0.5)^2 \times 2 + (0.5)^3 \times 3$

From the desk of:

$\left(Katz(A,C) = \beta^1 path^1(A,C) + \beta^2 path^2(A,C) + \beta^3 path^3(A,C) \right)$

From the desk of : Date:

$Katz(A,C) = 0 + 0.5 \times 0.5 \times 2 + 0.5 \times 0.5 \times 0.5 \times 3$
$= 0 + 0.5 + 0.375$
$= 0.875$

Similarly, if we want to find $Katz(A,H)$

$path^1(A,H) = 0$, $path^2(A,H) = 0$
$path^3(A,H) = 1$ (AEGH) (we can't take any other)
$path^4(A,H) = 1$ (AEFGH)

$Katz(A,H) = 0.5 \times 0 + 0.5^2 \times 0 + 0.5^3 \times 1 + 0.5^4 \times 1$
$= 0 + 0 + 0.125 + 0.0625$
$= 0.1875$

Similarly, we can continue for all possible pairs.
If value is => 0.5, most likely they will form a link.

Oddy

Soundarajan Hopcroft Score

To start with this problem we assume we have applied some community detection algorithms to the network to find the possible communities and they apply hopcroft.

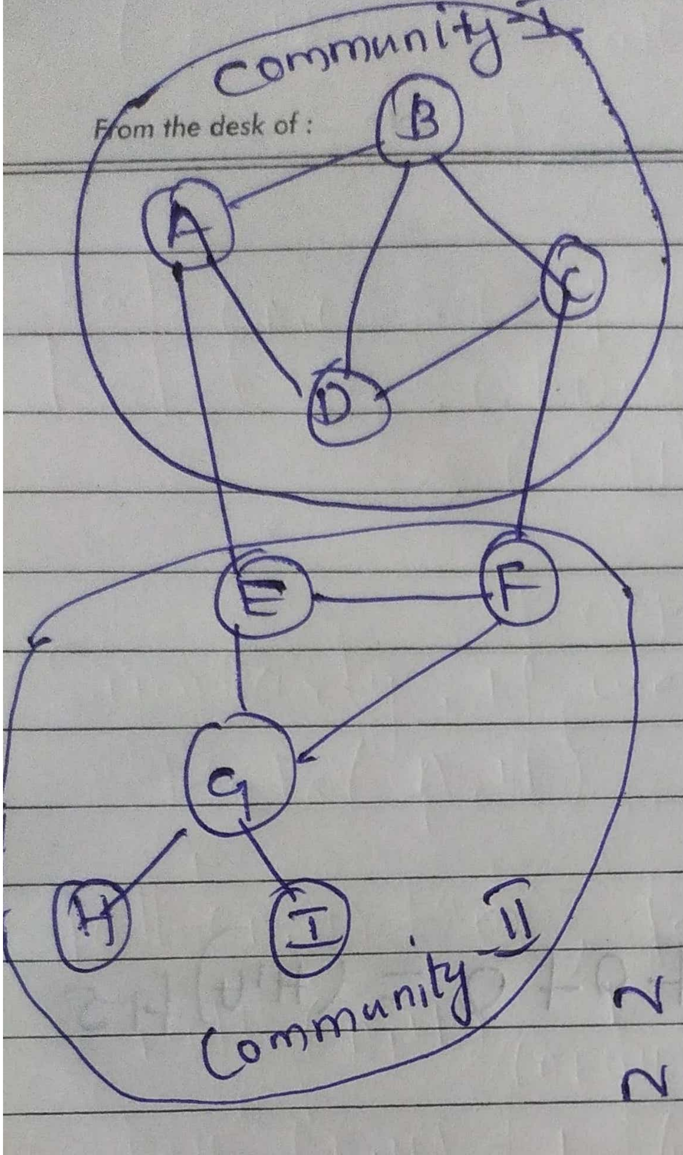
$$\text{Soundarajan-Hopcroft}_{(x,y)} = |N(x) \cap N(y)| + \sum_{u \in |N(x) \cap N(y)|} f(u)$$

$N(x)$ = neighbours of x

$N(y)$ = " of y

$$f(u) = \begin{cases} 1, & \text{if both } x \,\&\, y \text{ belongs to same community} \\ 0, & \text{if } x \,\&\, y \text{ belongs to different communities.} \end{cases}$$

From the desk of : Date:



S-H score(A, C)

$$= |N(A) \cap N(C)| + \sum_{u \in |N(A) \cap N(C)|} f(u)$$

$N(A) = \{B, D, E\}$

$N(C) = \{B, D, F\}$

$N(A) \cap N(C) = 2$

here $f(u) = 1$ since A & C belongs to same community

$\therefore SH_{(A,C)} = 2 + 1 + 1 = 4$

$u = N(A)$

$u = N(C)$

$= \underline{4}$

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$SH_{(A,H)} =$

$N(A) = \{B, D, E\}$

$N(H) = \{G\}$

$N(A) \cap N(H) = 0$

$f(u) = 0$ as A & H belongs to different groups.

$SH(A,H) = 0 + 0 + 0 = 0$