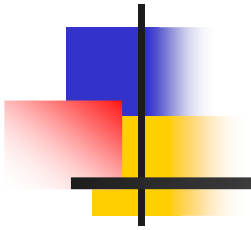
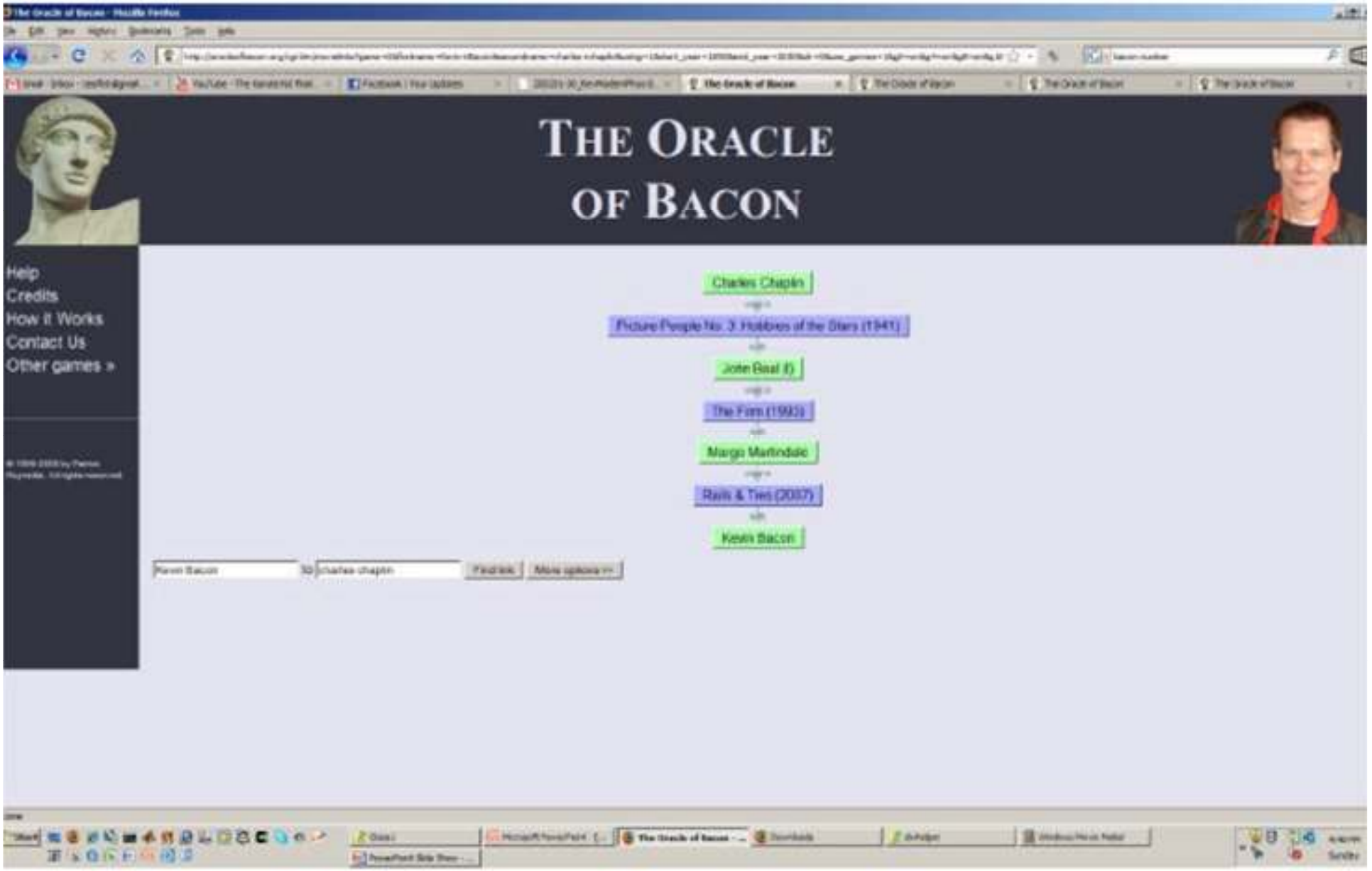


Centrality Measures

Measures of the "importance" of a node in a network


THE ORACLE
OF BACON
Help
Credits
How it Works
Contact Us
Other games »
Charles Chaplin
Picture People No. 3: Hobbies of the Stars (1941)
John Beal (I)
The Firm (1993)
Margo Martindale
Rails & Ties (2007)
Kevin Bacon

Hollywood Revolves Around

Click on a name to see that person's table.

Steiger, Rod (2.678695)
Lee, Christopher (I) (2.684104)
Hopper, Dennis (2.698471)
Sutherland, Donald (I) (2.701850)
Keitel, Harvey (2.705573)
Pleasence, Donald (2.707490)
von Sydow, Max (2.708420)
Caine, Michael (I) (2.720621)
Sheen, Martin (2.721361)
Quinn, Anthony (2.722720)
Heston, Charlton (2.722904)
Hackman, Gene (2.725215)
Connery, Sean (2.730801)
Stanton, Harry Dean (2.737575)
Welles, Orson (2.744593)
Mitchum, Robert (2.745206)
Gould, Elliott (2.746082)
Plummer, Christopher (I) (2.746427)
Coburn, James (2.746822)
Borgnine, Ernest (2.747229)

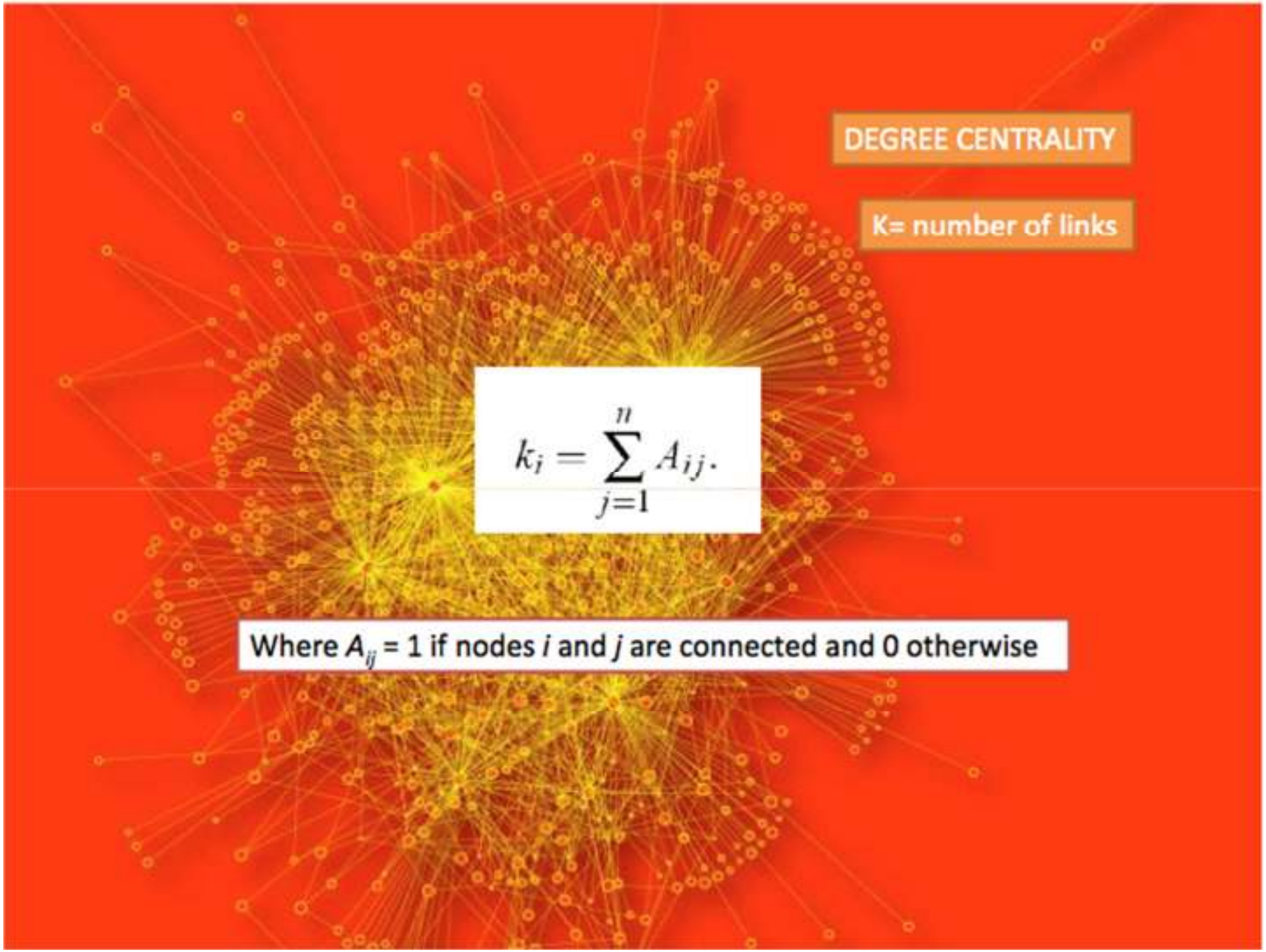
Most Connected Actors in Hollywood

(measured in the late 90's)

Mel Blanc 759
Tom Byron 679
Marc Wallice 535
Ron Jeremy 500
Peter North 491
TT Boy 449
Tom London 436
Randy West 425
Mike Horner 418
Joey Silvera 410

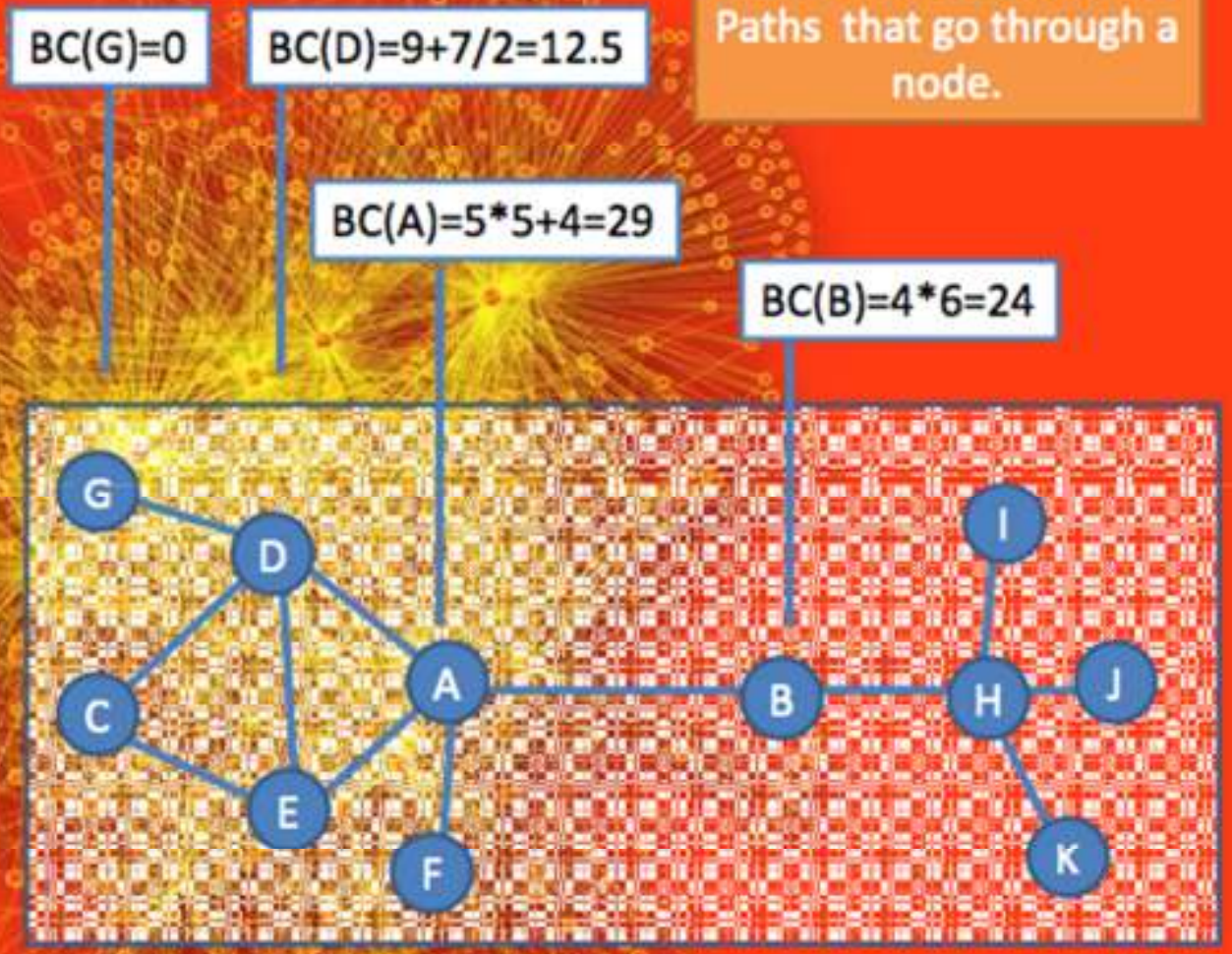
XXX

A-L Barabasi, "Linked", 2002


DEGREE CENTRALITY
K= number of links
$k_i = \sum_{j=1}^{n} A_{ij}.$
Where A_{ij} = 1 if nodes *i* and *j* are connected and 0 otherwise

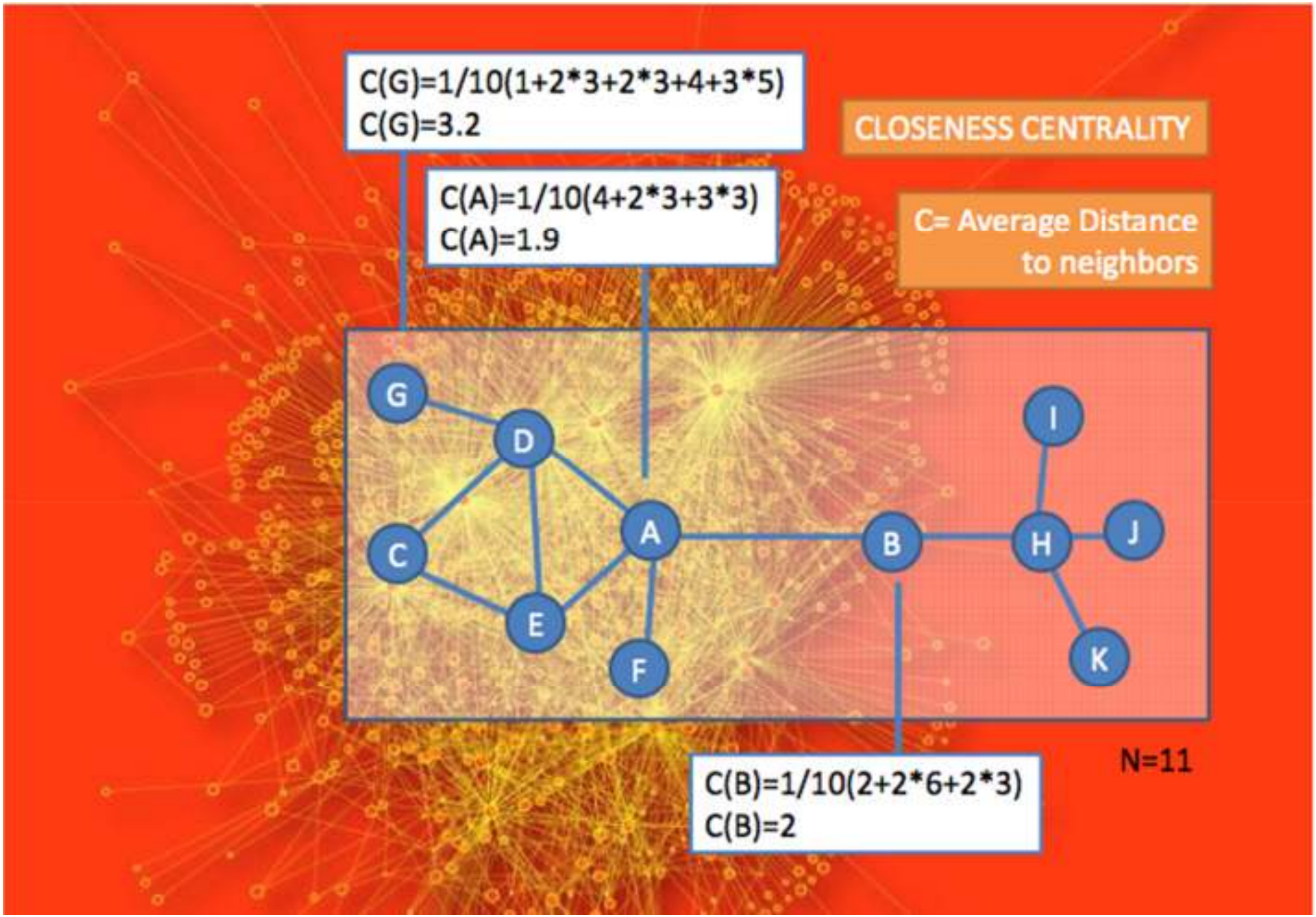
BETWENNESS CENTRALITY

BC= number of shortest Paths that go through a node.



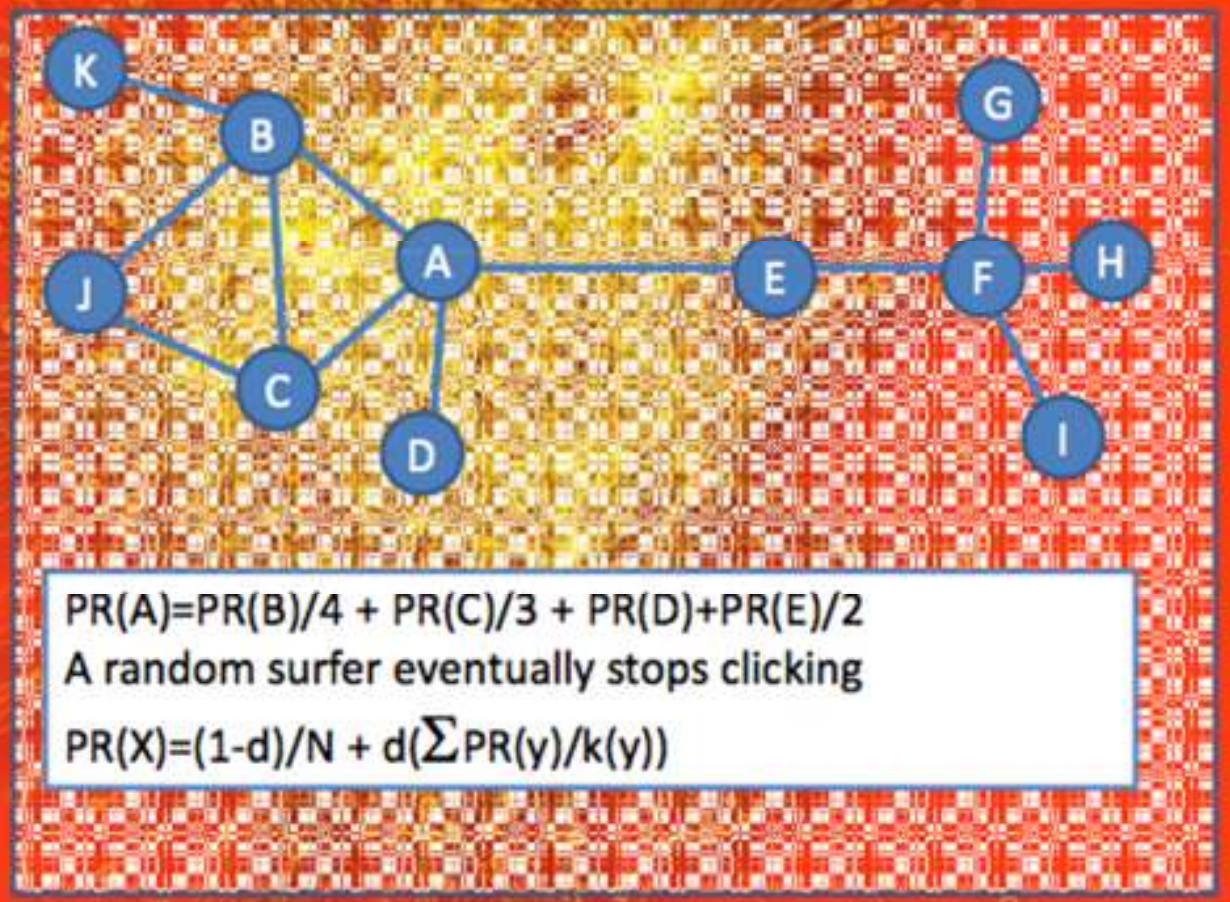
A set of measures of centrality based on betweenness

LC **Freeman** - Sociometry, 1977 - jstor.org


C(G)=1/10(1+2*3+2*3+4+3*5)
C(G)=3.2
CLOSENESS CENTRALITY
C(A)=1/10(4+2*3+3*3)
C(A)=1.9
C= Average Distance to neighbors
G
D
I
A
B
H
J
C
E
F
K
N=11
C(B)=1/10(2+2*6+2*3)
C(B)=2

PAGE RANK

PR=Probability that a random walker with interspersed Jumps would visit that node.
PR=Each page votes for its neighbors.



PR(A)=PR(B)/4 + PR(C)/3 + PR(D)+PR(E)/2
A random surfer eventually stops clicking

$PR(X)=(1-d)/N + d(\Sigma PR(y)/k(y))$

PAGE RANK

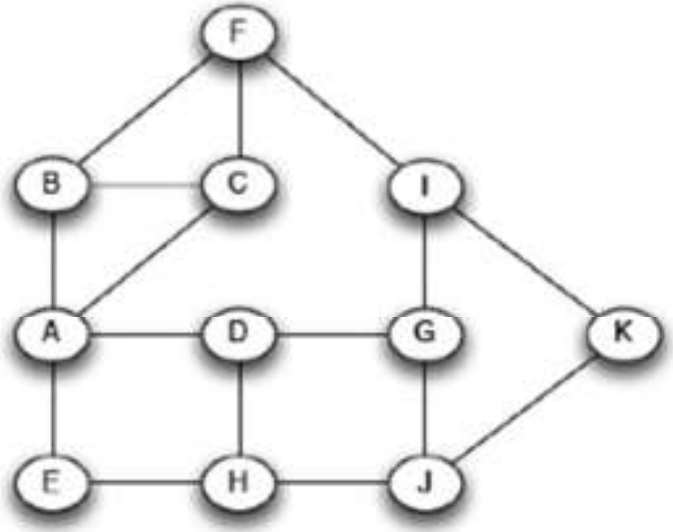
PR=Probability that a random Walker would visit that node.
PR=Each page votes for its neighbors.

$$\mathbf{R} = \begin{bmatrix} PR(p_1) \\ PR(p_2) \\ \vdots \\ PR(p_N) \end{bmatrix}$$

$$\mathbf{R} = \begin{bmatrix} (1-d)/N \\ (1-d)/N \\ \vdots \\ (1-d)/N \end{bmatrix} + d \begin{bmatrix} \ell(p_1,p_1) & \ell(p_1,p_2) & \cdots & \ell(p_1,p_N) \\ \ell(p_2,p_1) & \ddots & & \vdots \\ \vdots & & \ell(p_i,p_j) & \\ \ell(p_N,p_1) & \cdots & & \ell(p_N,p_N) \end{bmatrix} \mathbf{R}$$

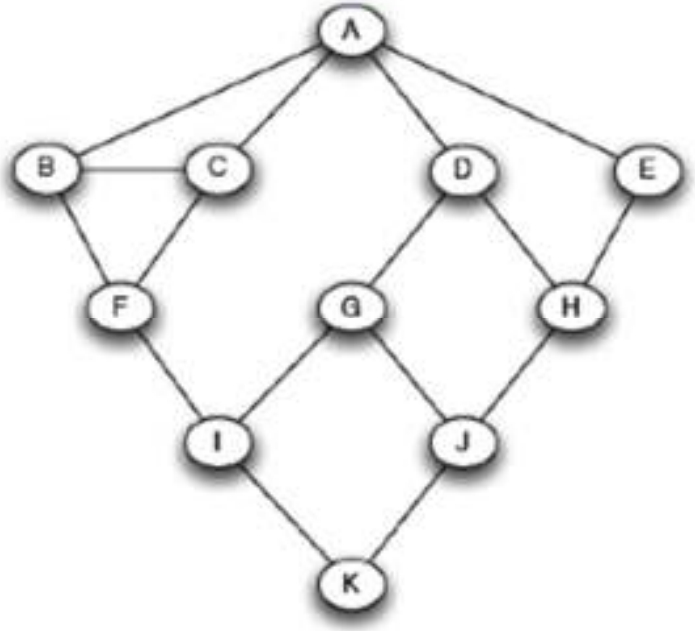
$$\sum_{i=1}^{N} \ell(p_i,p_j) = 1,$$

How to compute betweenness?



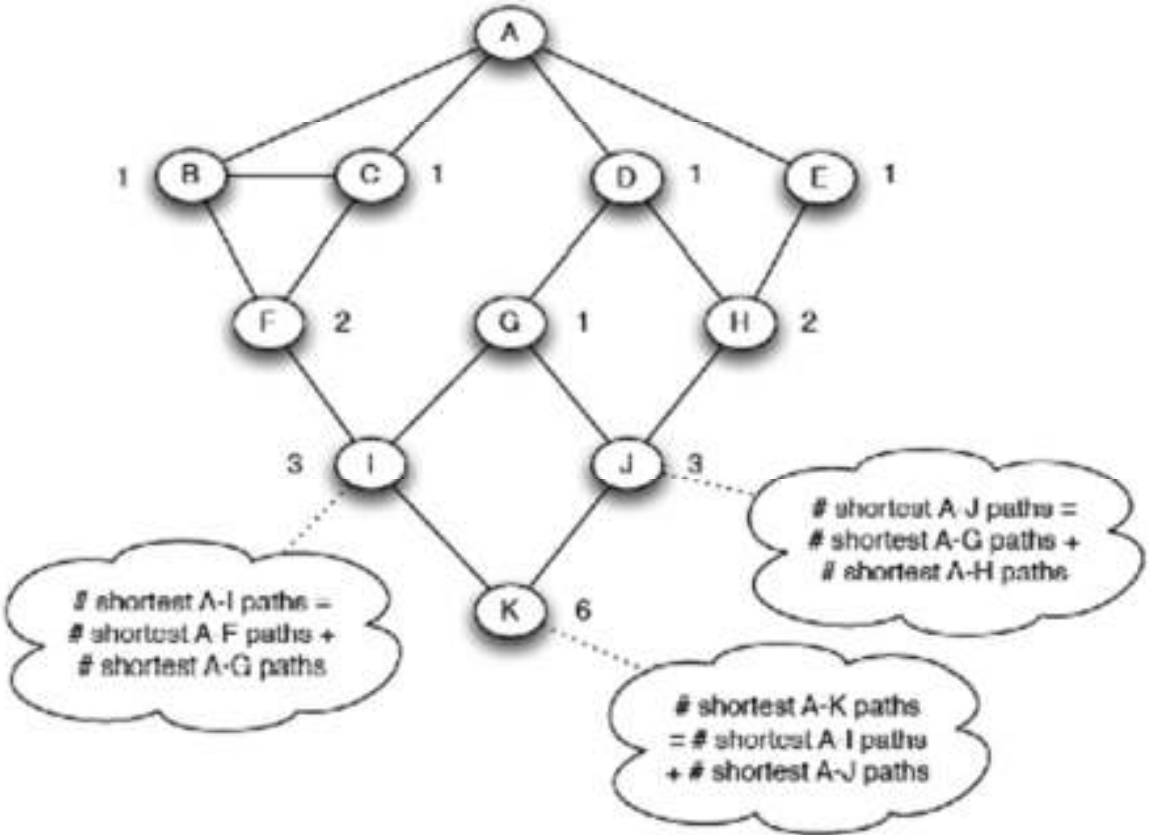
- Want to compute betweenness of paths starting at node A

- Breath first search starting from A:



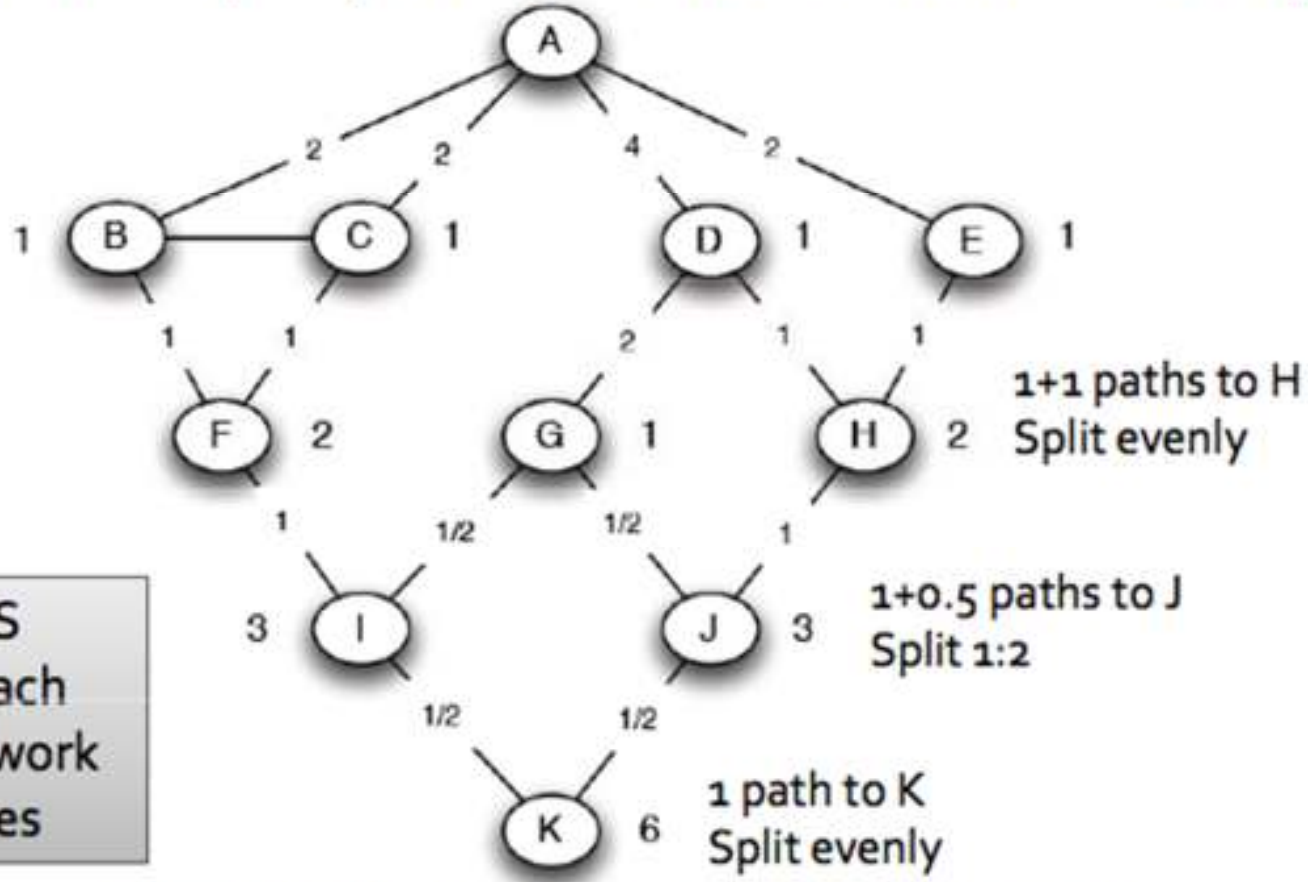
How to compute betweenness (2)

- Count the number of shortest paths from A to all other nodes of the network:



How to compute betweenness (3)

- Compute betweenness by working up the tree: If there are multiple paths count them fractionally



- Repeat the BFS procedure for each node of the network
- Add edge scores