



Social Media Analytics: Graph Essentials



BITS Pilani
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Lecture:6
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Recap

Traversal Algorithms

- **Depth-First Search (DFS)**
- **Breadth-First Search (BFS)**

Shortest path algorithms

Dijkstra's Algorithm

MST

1. Kruskal's Algorithm

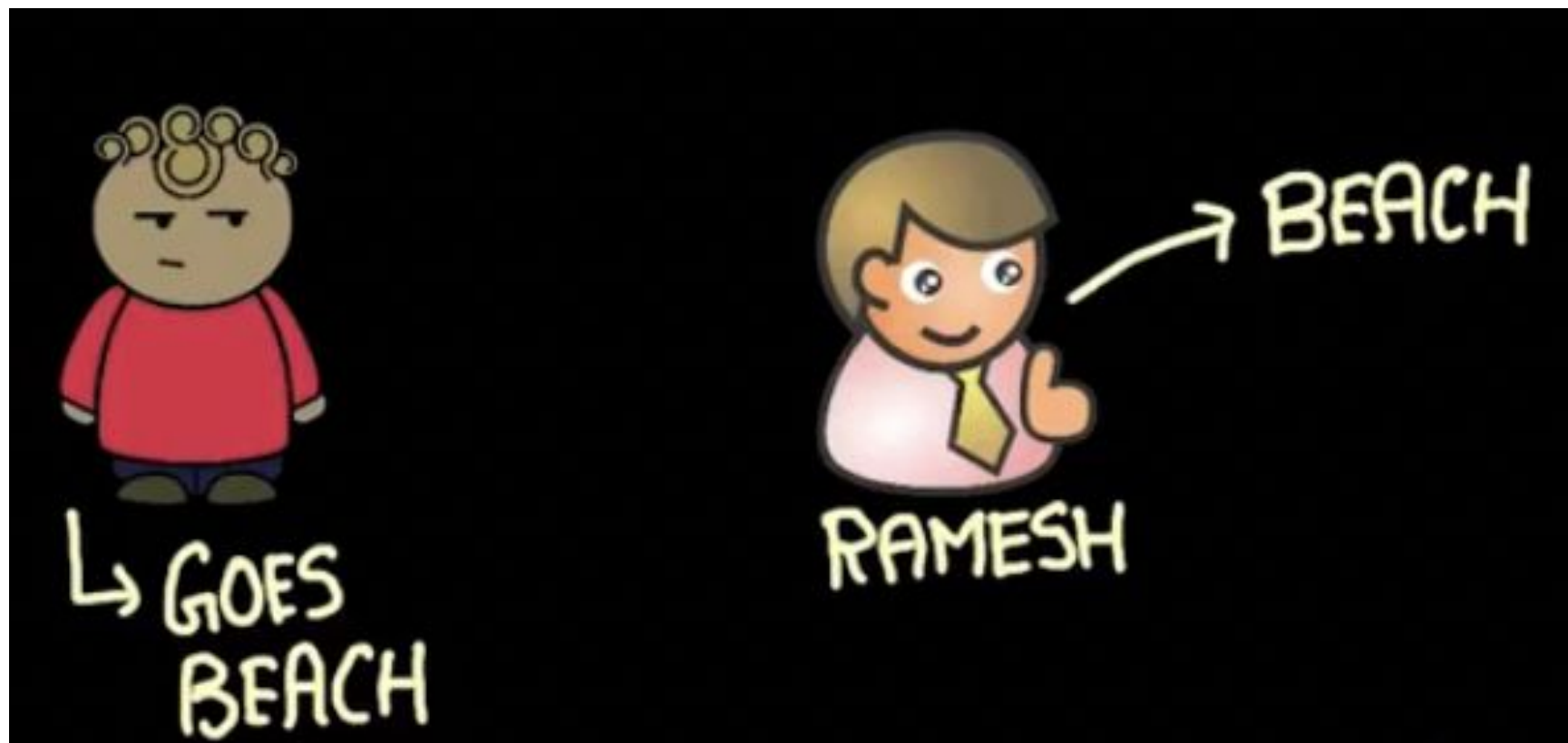
2. Prim's Algorithm

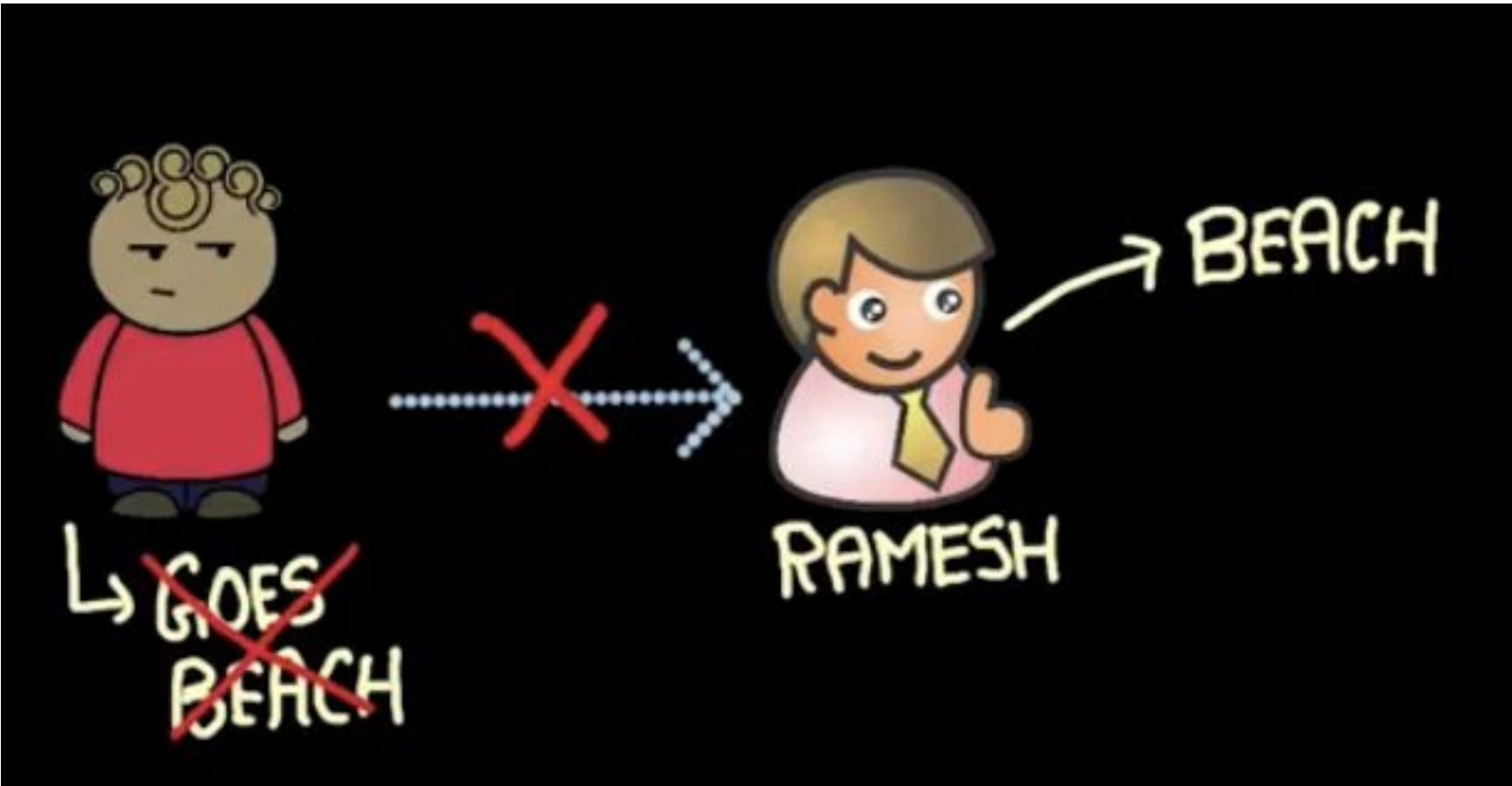
Clustering Coefficient

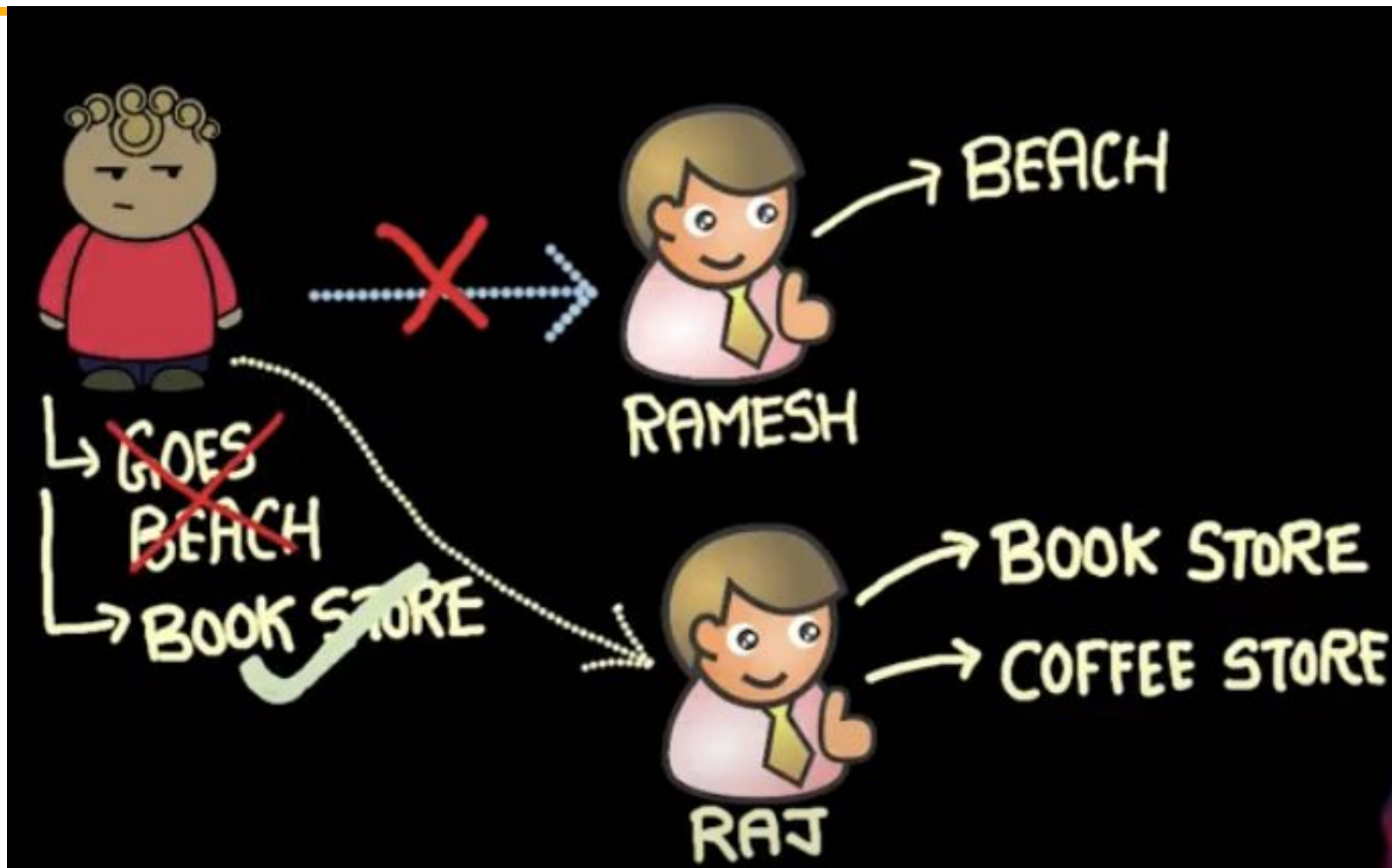
Centrality

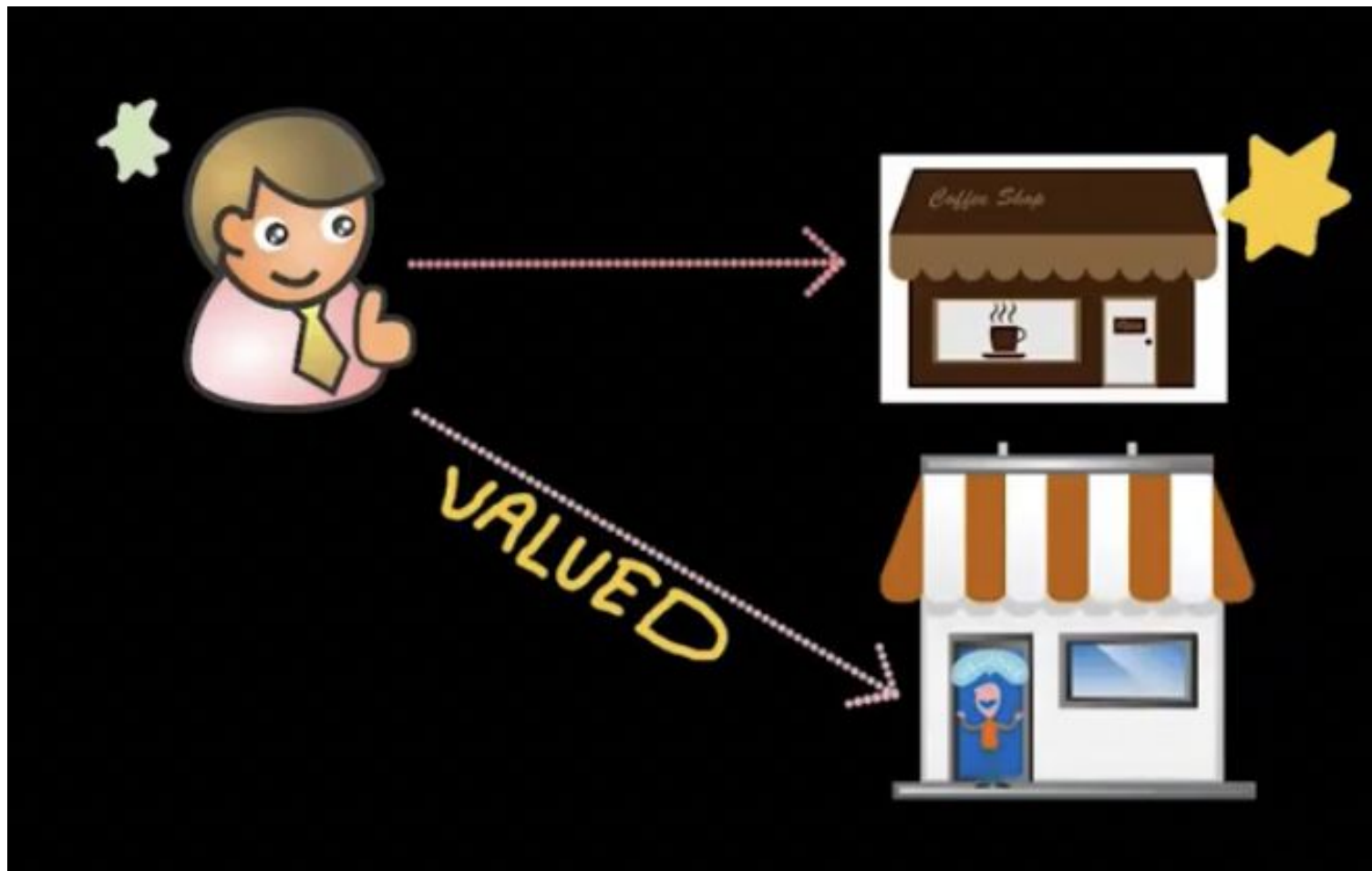
Example











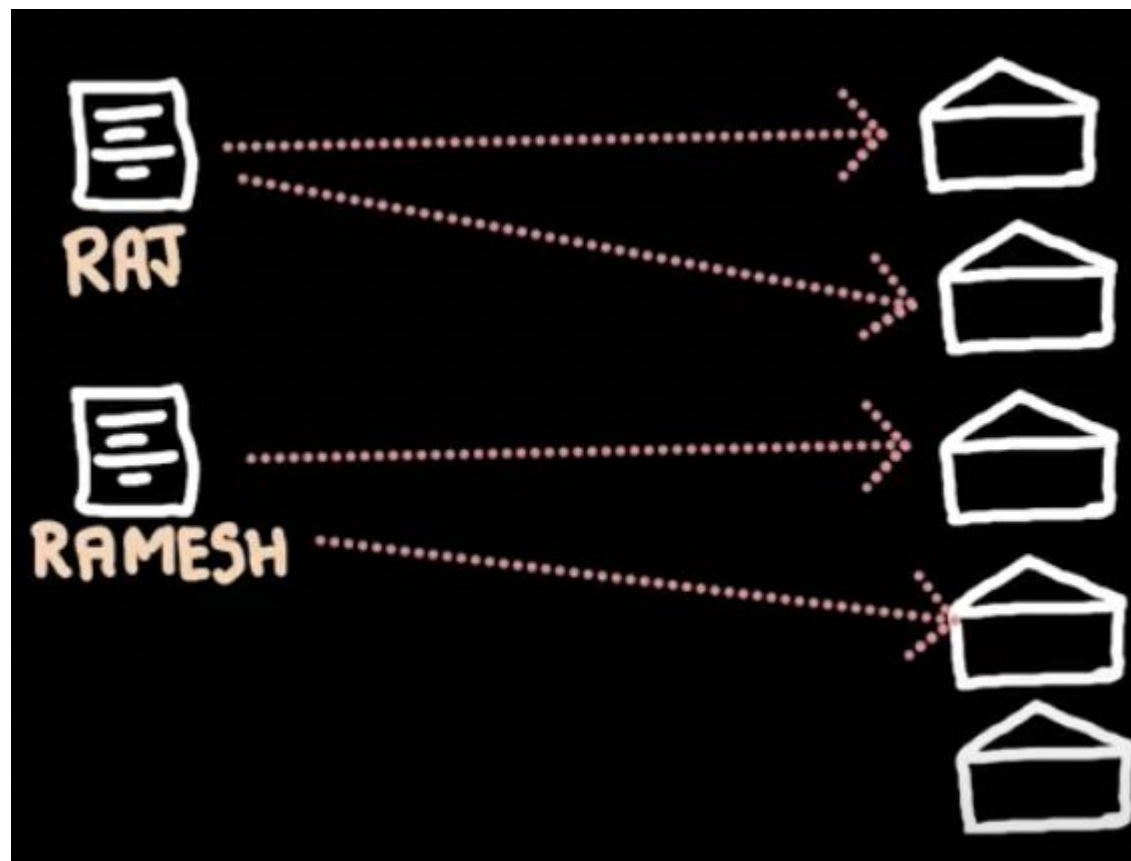


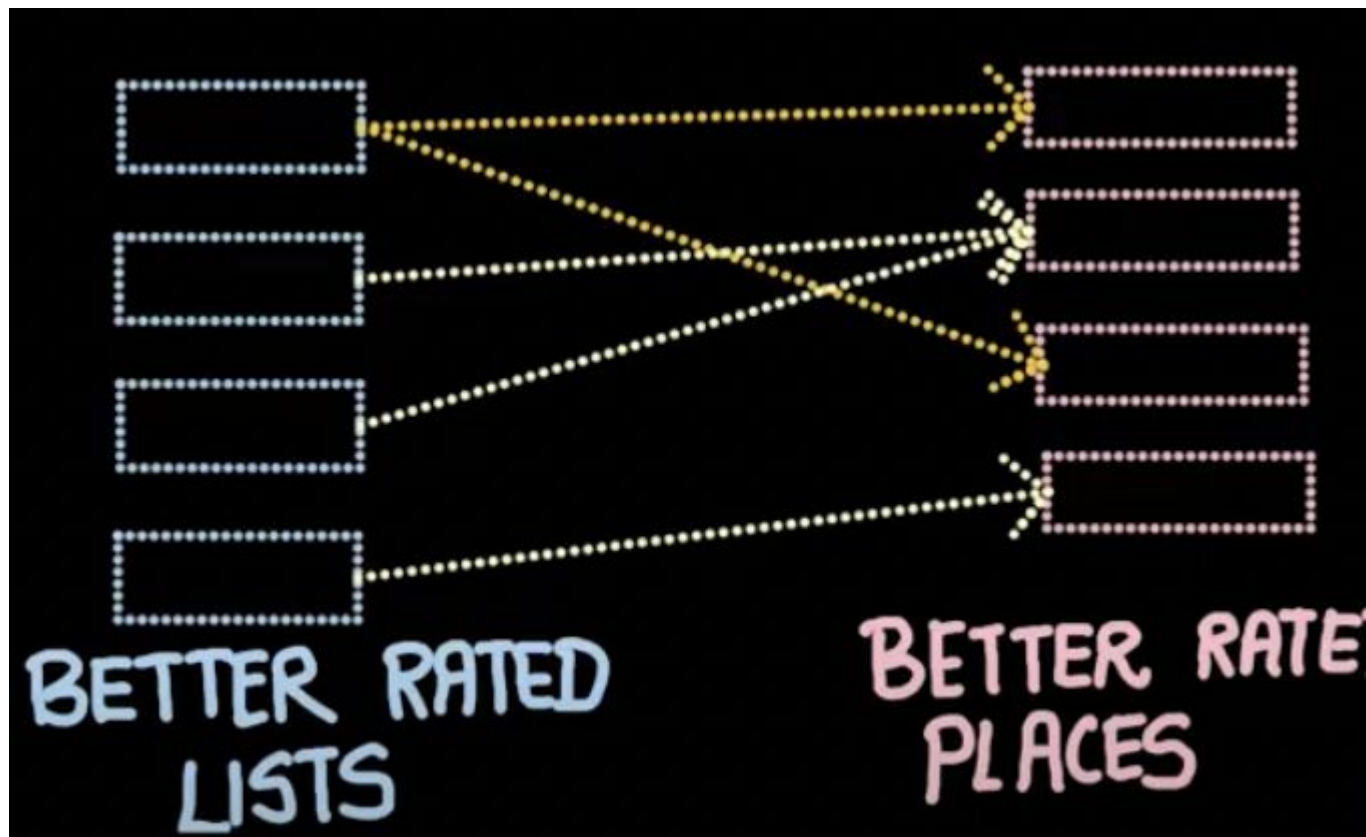
Another example of repeated improvement



lab

supervisor and student.

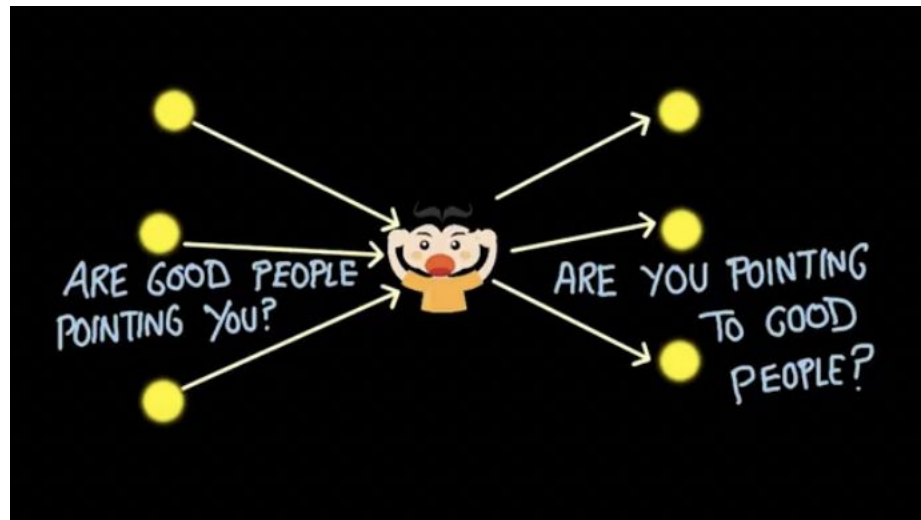




Principle of Repeated Improvement



- Hubs and Authorities
- A node can be given points as hubs and authorities
- A node is a good authority if it is pointed to by good hubs, and a node is a good hub if it points to good authorities.



Hubs

- Links to popular nodes
- Eg. In citation network the paper that refers to important papers links a good survey paper.
- Hub Score is sum of authority scores of all the nodes Pointed out by HUB node
- Hub score of node i

$$h_i = \sum_{i \rightarrow k} a_k$$

Authority



- These are the nodes that are themselves important.
- **EG. Dijkstra algorithm**
- Authority score is sum of all the hubscores of nodes pointing to authority node
- Authority score of node i

$$a_i = \sum_{j \rightarrow i} h_j$$

Matrix form



$$\mathbf{a} = A^T \mathbf{h}$$

$$\mathbf{h} = A \mathbf{a}$$

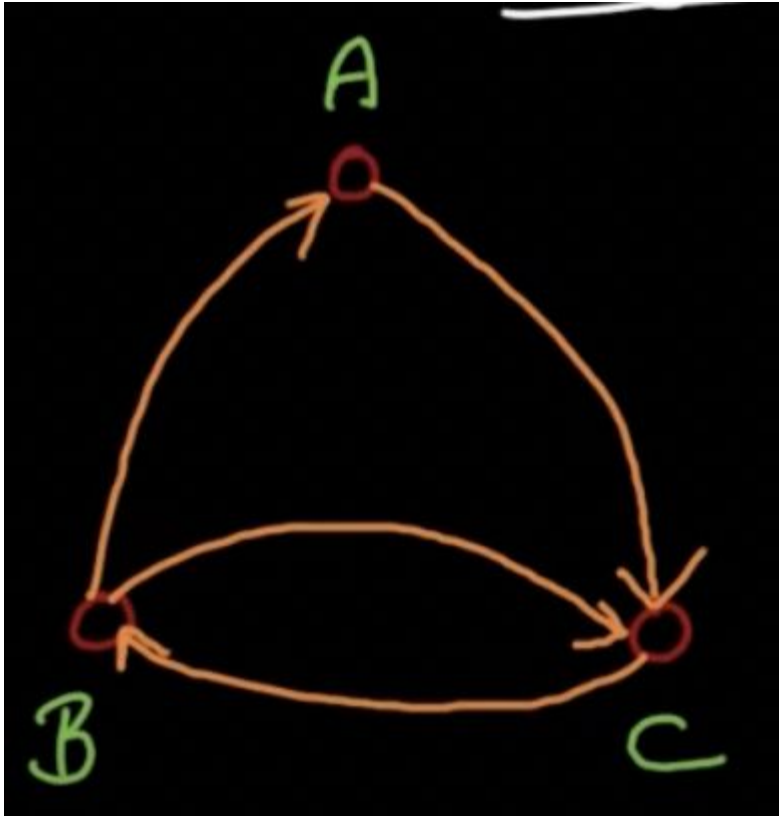
Hubs and Authorities

These two scores are **mutually dependent**:

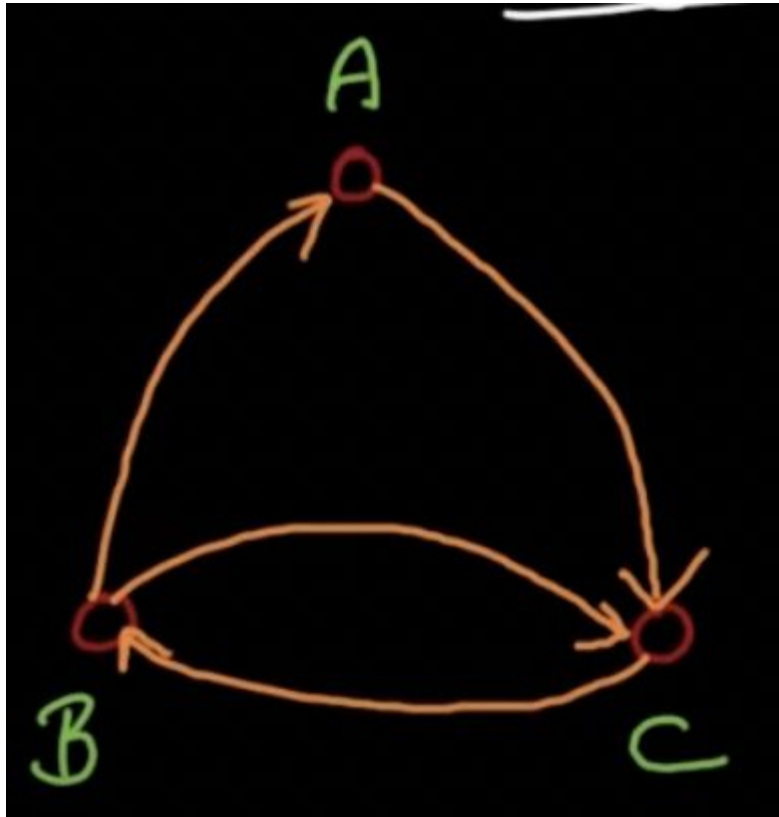
- A good hub points to good authorities
- A good authority is pointed by good hubs

The mathematical hub and authority scores always **converge** after repeated iterations of the HITS update equations.

Convergence



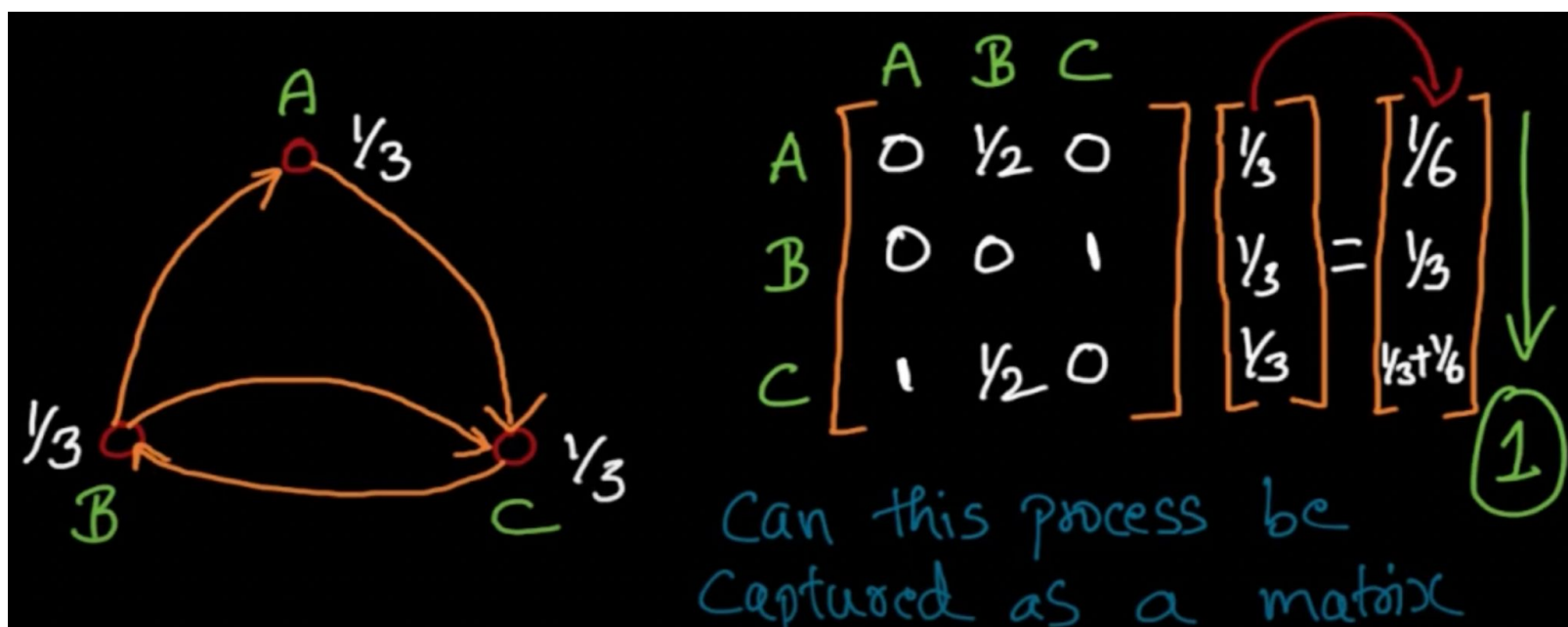
Convergence



A	B	C
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{3} + \frac{1}{6}$

What will happen when this continues

	A	B	C
I	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
II	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$
III	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{6} + \frac{1}{6}$





Questions?

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