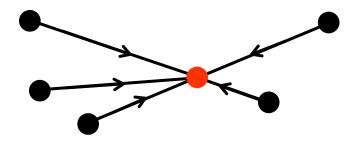
Google and the Random Surfer

How does Google figure out which web pages are most important?



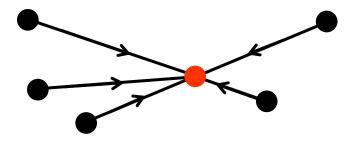


An important page is one that lots of pages point to?

No ...

Google and the Random Surfer

How does Google figure out which web pages are most important?

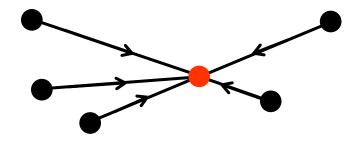




An important page is one that lots of important pages point to.

Google and the Random Surfer

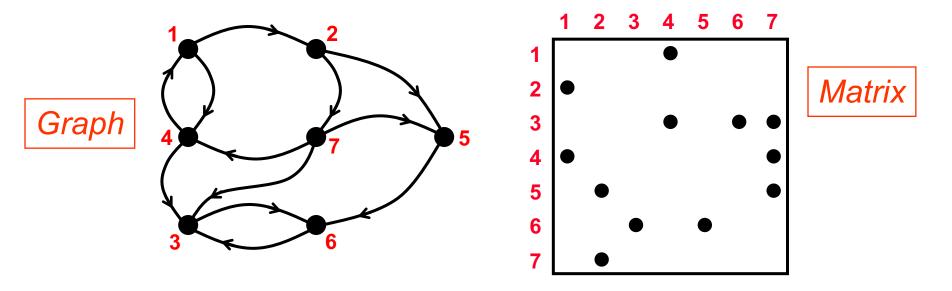
How does Google figure out which web pages are most important?





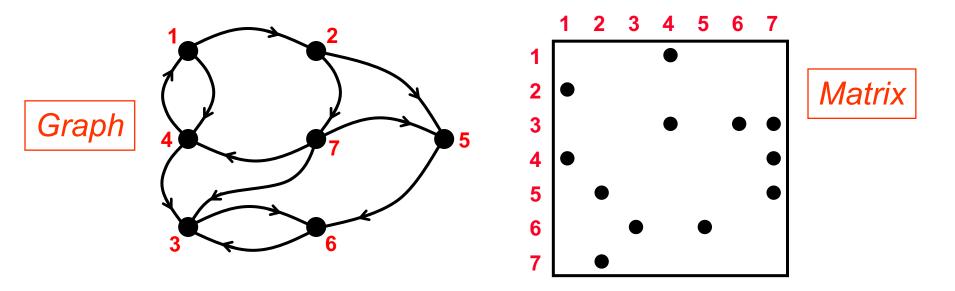
- An important page is one that lots of important pages point to.
- Start at any web page and follow links at random. Forever.
- You'll see "important" pages more often than unimportant ones.

Analyzing the Web with graphs and matrices



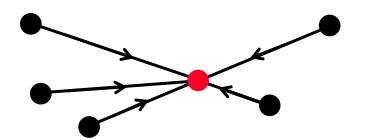
- Graph nodes are web pages
- Arrows between nodes are links between web pages
- Matrix entries are links from "column" pages to "row" pages
- The Page Rank comes from algebra on the matrix

Analyzing the Web with graphs and matrices



- Graph nodes are web pages
- Arrows between nodes are links between web pages
- Matrix entries are links from "column" pages to "row" pages
- The Page Rank comes from algebra on the matrix
- The matrix has over 130,000,000,000,000 rows & columns (2016)

Random Surfer Rule



An important page is one that many important pages point to.

- With probability p (= .85), follow a random link from this page.
- With probability m = 1 p (= .15), choose a page at random.
- (If there are no links out of this page, pretend it links to all other pages.)

A Page Rank Matrix

- Importance ranking of web pages
- Stationary distribution of a Markov chain
- Power method: matvec and vector arithmetic
- Page rank matrix from a web crawl of mit.edu (170,000 pages)

