Computing

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This Talk

- Part I — Computing

- Part II — Computing at SCU

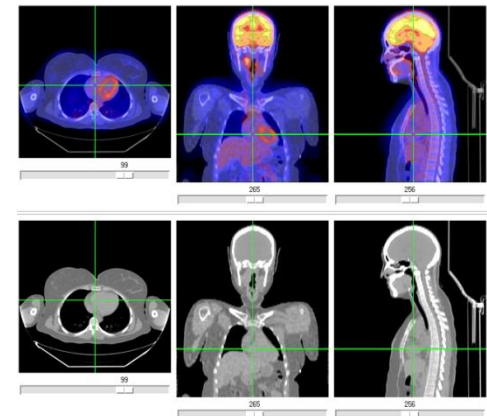- Part III — Today's activity: PageRank

PART I — COMPUTING

What is Computing?

- Analysis, design and development of computer systems

- It is not just about programming

- It teaches you how to think more methodically and how to solve problems more effectively

Computing is everywhere!

What is Computing?
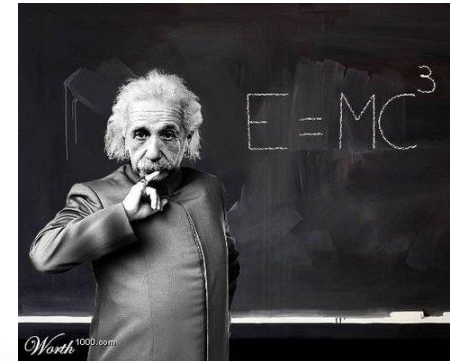
- Computing includes a variety of fields:
    - Mathematics
    - Computer science
    - Computer engineering
    - Information science
    - Electrical engineering

What is Computing?

- ## What is a computer professional?
  - Will I have to grow fuzzy hair?

- ## What does s/he do?
  - Will I have to sit in front of
    a computer all day?

- ## What kind of people will I work with?
  - Will I have to become a geek nerd?

What is Computing?

- FUN, COOL, and EXCITING
  - Cutting edge projects
  - Exciting and talented people
  - All over the world, in every sector
  - Significant impact on society and our planet

Why Study Computing?

- **Intellectually interesting**
  - Logical reasoning and mathematical thinking
  - Possible workings of the human mind

Why Study Computing?

- **Computing supports and links to most other areas of study**
    - Computing and neuroscientists – the brain
    - Computing and Biologists – Genome
    - Computing and Meteorologists – weather prediction
  - Future scientists require basic knowledge of Computing

Why Study Computing?

- **Computing teaches problem solving**

  - Decomposition, abstraction, modular design

  - Analysis and design are carefully reviewed

  - Always new methods being investigated

Why Study Computing?

- **Computing builds teamwork and leadership skills**
  - Plan, organize, control, lead complex projects
  - Learn to deal with mix of talents
  - Estimate and deal with risk

Why Study Computing?

- **Computing develops life-long learning skills ...** *"Change is the only constant"*

– Promotes learning to learn

"if GM had kept up with the technology like the computer industry has, we would all be driving $25.00 cars that got 1,000 miles to the gallon" – Bill Gates

– Exponential growth makes many predictions look foolish

False Predictions

- *"I think there is a world market for maybe five computers"* -- Thomas J. Watson, founder and Chairman of IBM, 1943.

- *"Computers in the future may weigh no more than 1.5 tons"* -- *Popular Science*, 1949.

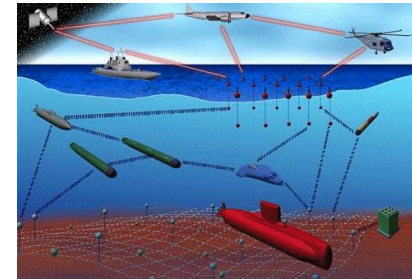- *"640K ought to be enough for anybody"* -- Bill Gates, 1981.
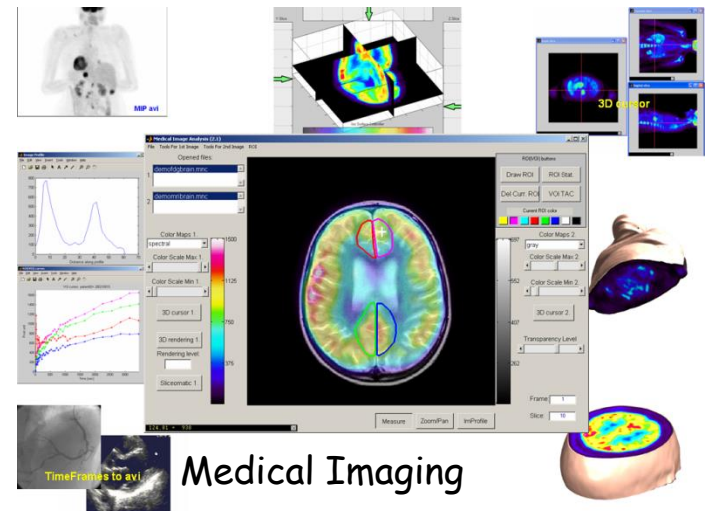
Future Applications

Self-driving car

Personalized Healthcare

Transforming the nation's defense

Internet of Things

Medical Imaging

Comp. Science & Engineering

- Computer science
  - Often more mathematical
  - Computability theory
  - Algorithmic complexity
- Computer engineering
  - Often more hardware-oriented
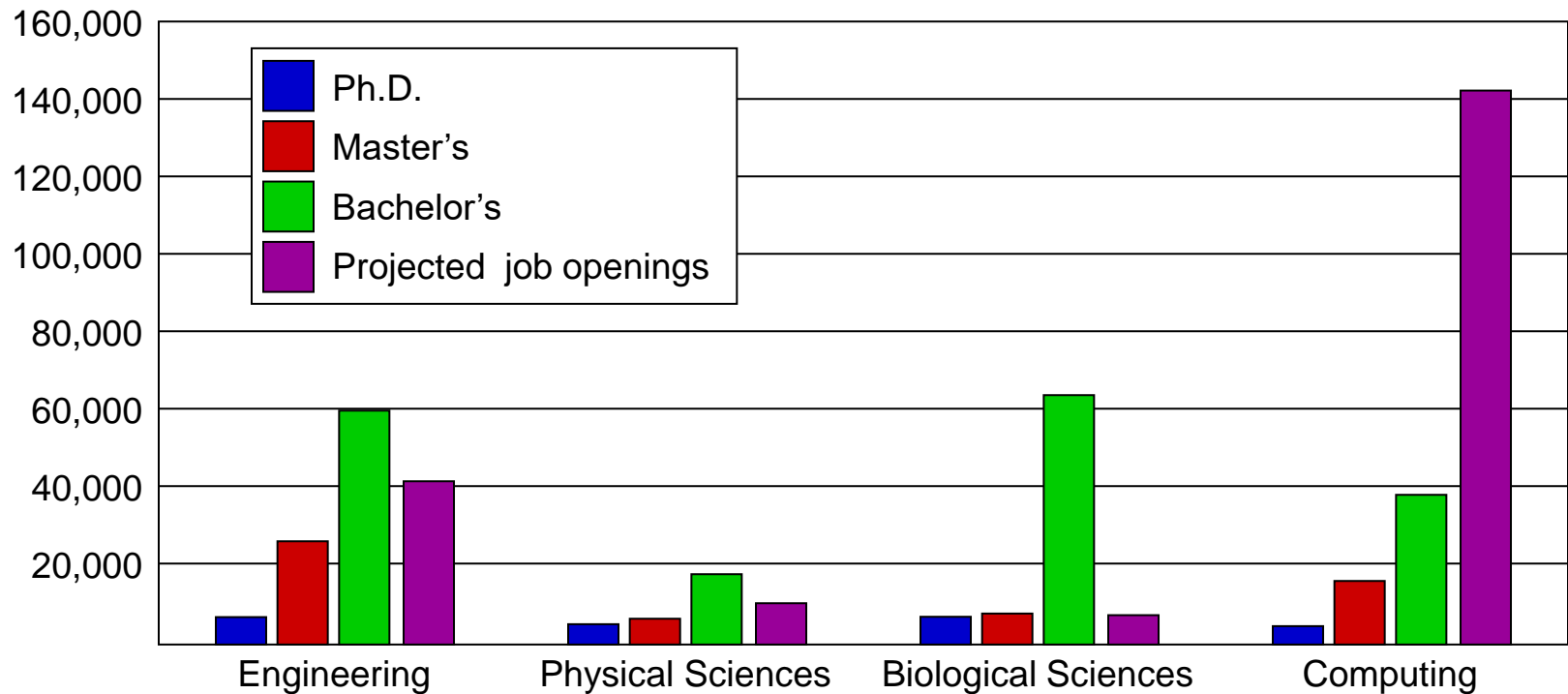 - Image and signal processing
  - Computer graphics

Career Opportunities

- System architect
- Network engineer
- Computer architect
- Software engineer
- Security specialist
- Game designer
- Test engineer
- Entrepreneur, musician, athlete, and more

Degree Production *vs.* Job Openings

Be Creative!

- Computing is the only tech field in which you can create a product from scratch and commercialize it independently

PART II — COMPUTING AT SCU

Computing Degrees at SCU

- Undergraduate degrees
  - Computer science and engineering (CSE)
  - Web design and engineering (WDE)
  - Mathematics and computer science
- Graduate degrees
  - Computer science and engineering
  - Software engineering
- 5-year Master's program

Undergraduate CSE

- Combination of computer science and computer engineering
- Focuses on theoretical and practical aspects of computing
- Design and construction of both hardware and software systems
  - Computer networks, operating systems, algorithms, compilers, software engineering, embedded programming, Web programming, robotics, 3D animation

Undergraduate WDE

- New major started in 2009
  - One of the first such programs in the country
- Combines computing with other disciplines:
  - Graphic arts
  - Communication
  - Sociology
- What will these specialized graduates do?
  - Improve Web infrastructure
  - Develop interactive, multimedia content
  - Analyze the huge amount of information on the Web (Big data)
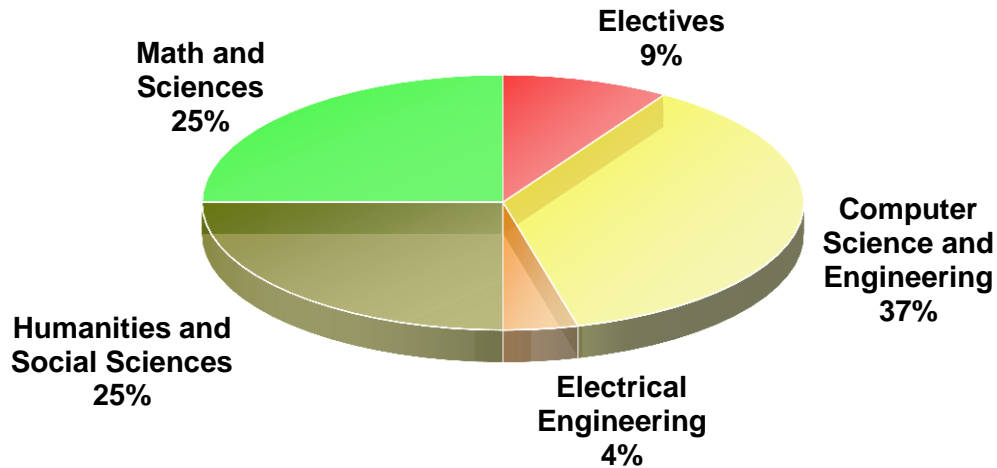 - Understand the societal impact of the Web

Where Will You Work?

- Recent graduates went to work for:
  - Cisco, Apple, Microsoft, IBM, Google, Facebook, Groupon, Amazon, Anritsu, F5 Networks
  - Starting salary range: $70K–$100K
- Recent graduates also continued their education:
  - Ph.D program at Berkeley, UCSD, etc.
  - M.S. programs at SCU, CMU, Stanford, etc.

Coursework

Math and Sciences 25%
Electives 9%
Computer Science and Engineering 37%
Humanities and Social Sciences 25%
Electrical Engineering 4%

Computer Science and Engineering

Electives 14%
Math and Sciences 12%
Computer Science and Engineering 32%
Humanities and Social Sciences 26%
Studio Art, Communication, and Sociology 16%
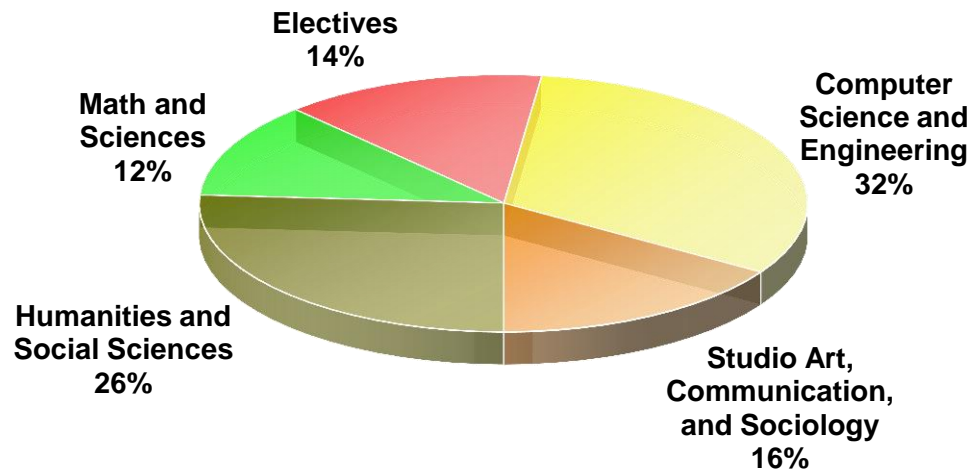
Web Design and Engineering

PART III — TODAY'S ACTIVITY

The History of PageRank

- PageRank was developed by Larry Page (hence the name *Page*-Rank) and Sergey Brin.

- It is first as part of a research project about a new kind of search engine. That project started in 1995 and led to a functional prototype in 1998.

- Shortly after, Page and Brin founded Google.

Link Structure of the Web
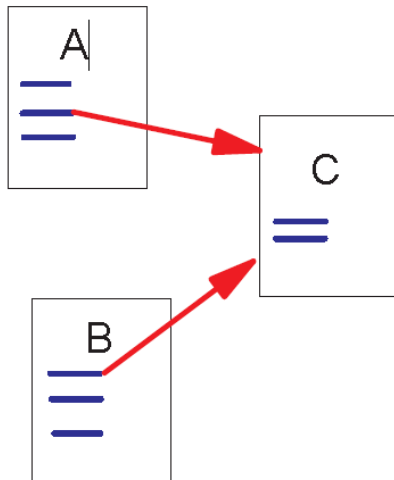
In-links and Out-links:
➢A and B are C's in-links
➢C is A and B's out-link

Assess the importance of a page based on links

Intuitively, a webpage is important if it has a lot of in-links.

What if a webpage has only one link coming from www.yahoo.com?

Intuition

"a page is important if <u>many important</u> pages <u>exclusively</u> link to it."

PageRank Calculation

- Page i's importance (or PageRank) is the sum of the votes from its inlinks

- Each link's vote is proportional to the importance (or Pagerank) of its source page

- If page j with PageRank $PR(j)$ has n outlinks, each link gets $PR(j)/n$ votes

Mathematical formulation

$$PR(i) = \sum_{j \text{ is inlink of } i} \frac{PR(j)}{n_j}$$

$$\sum_{v} PR(v) = 1$$

Example 1
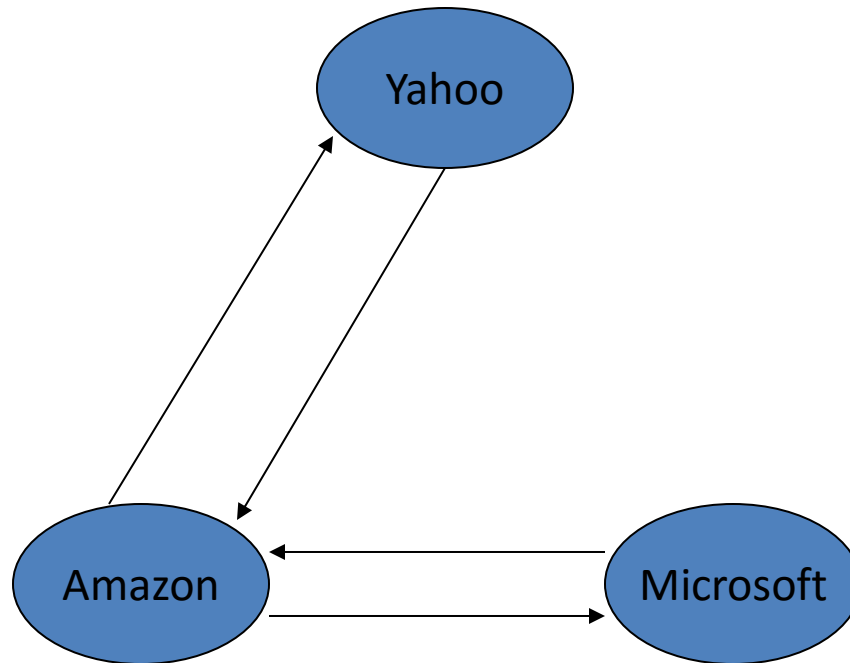
Example 2
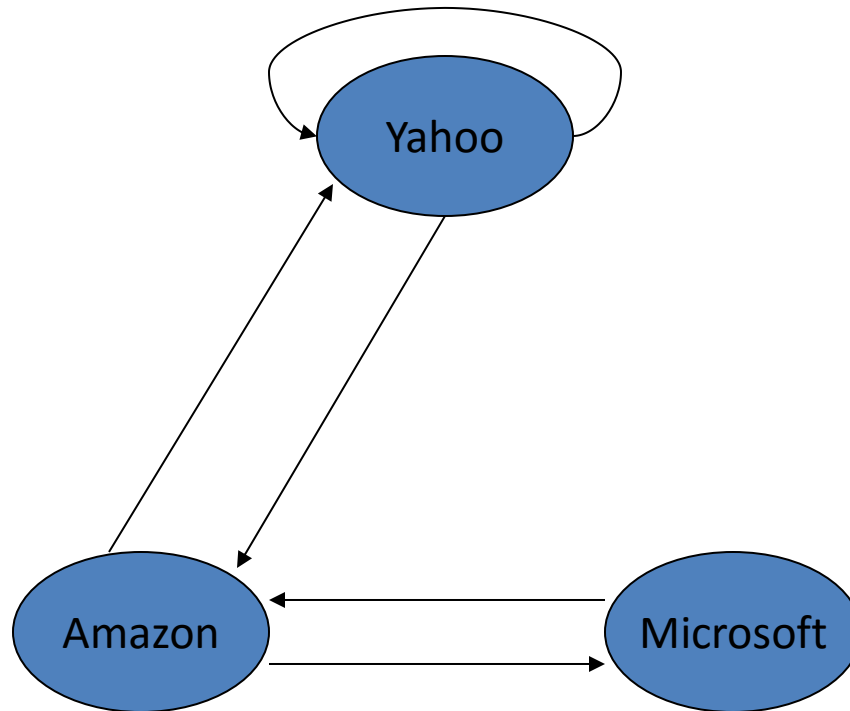
Example 3
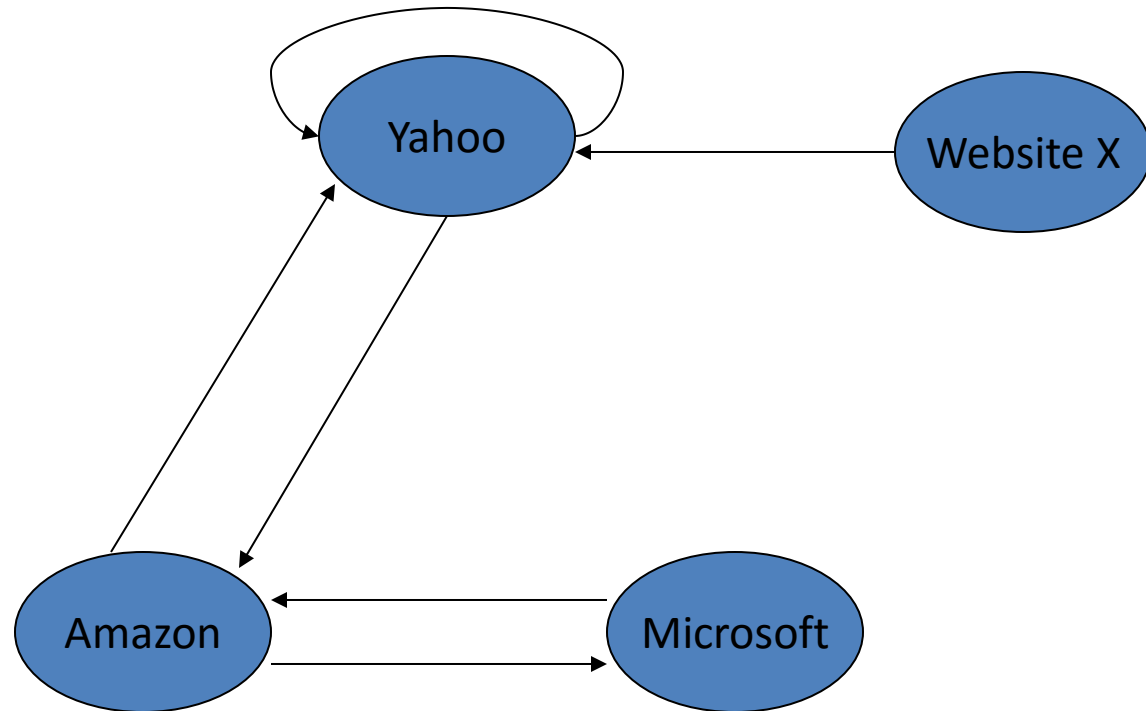
Example 4
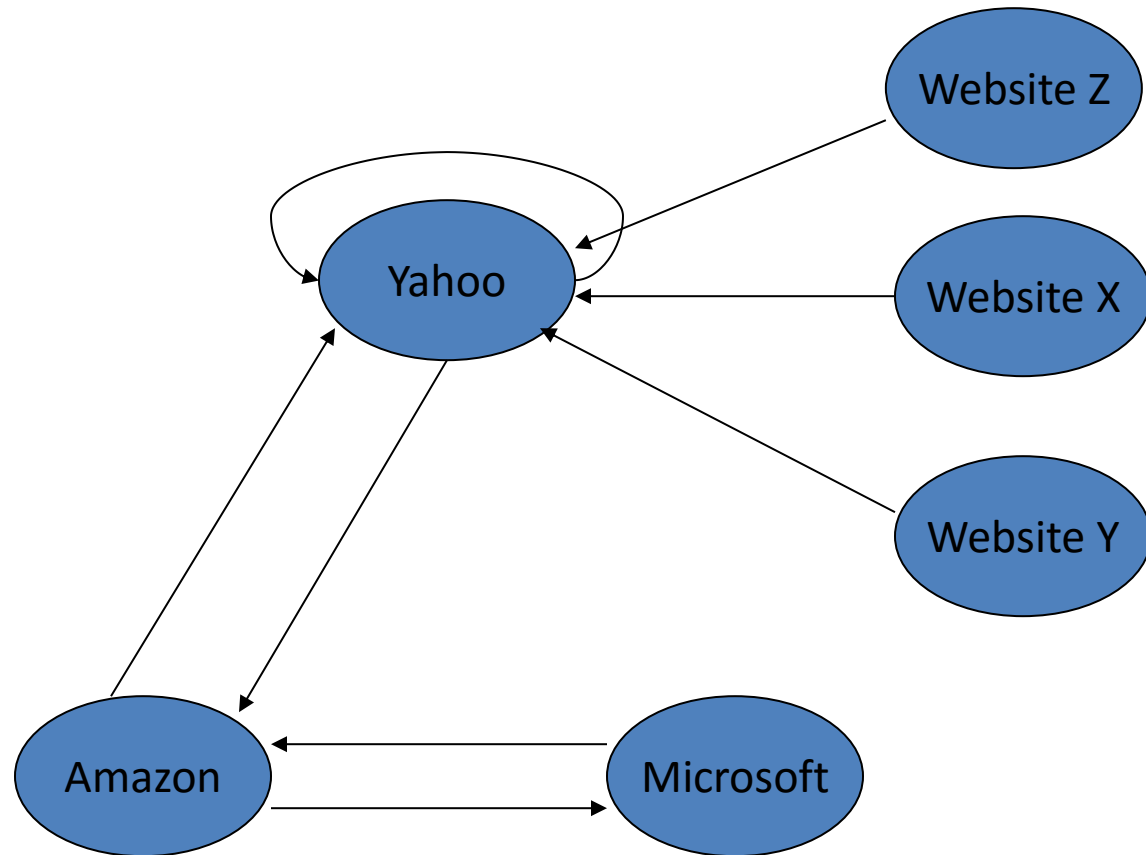
Search Engine Optimization

- Increase the visibility of your website in search engines by considering how PageRank works

- Link spam takes advantage of PageRank

Link Spam

A form of spamming trying to increasing the PageRank of member pages
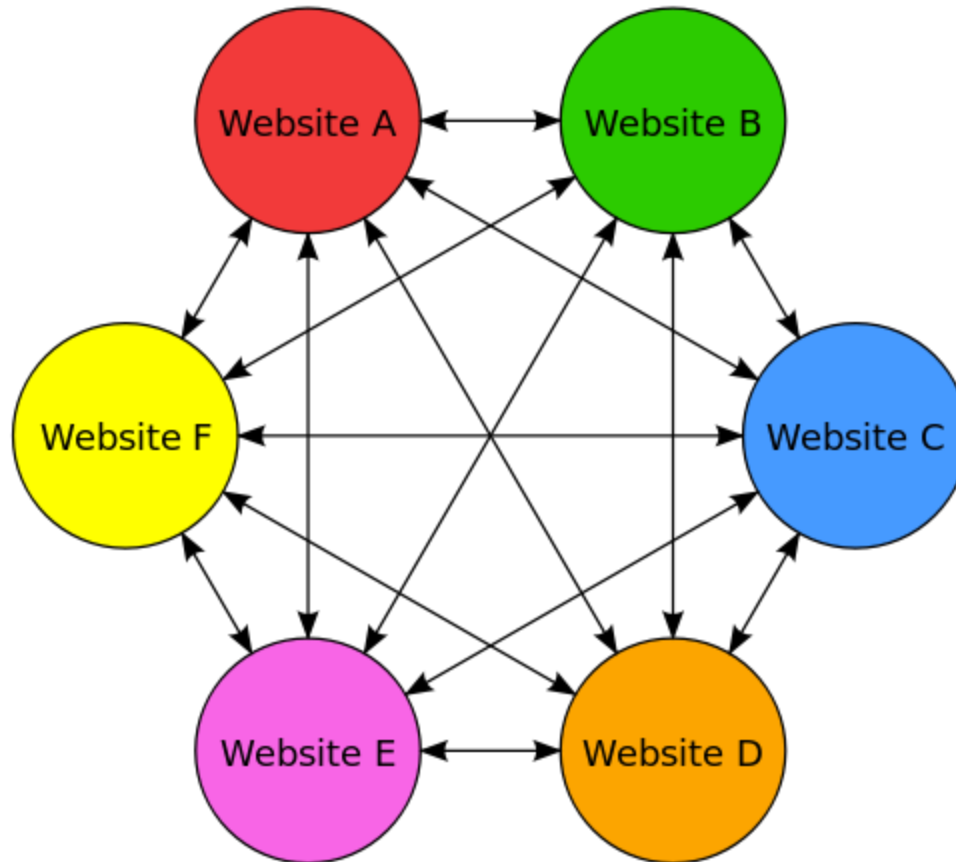
Question

- How to find the important persons on Twitter by applying PageRank?

Toolbar PageRank

- You can install an Add-on in your browser to check the PageRank value of any website

Toolbar PageRank (log base 10)	Real PageRank
0	0 - 10
1	100 - 1,000
2	1,000 - 10,000
3	10,000 - 100,000
4	and so on…

Anchor Text
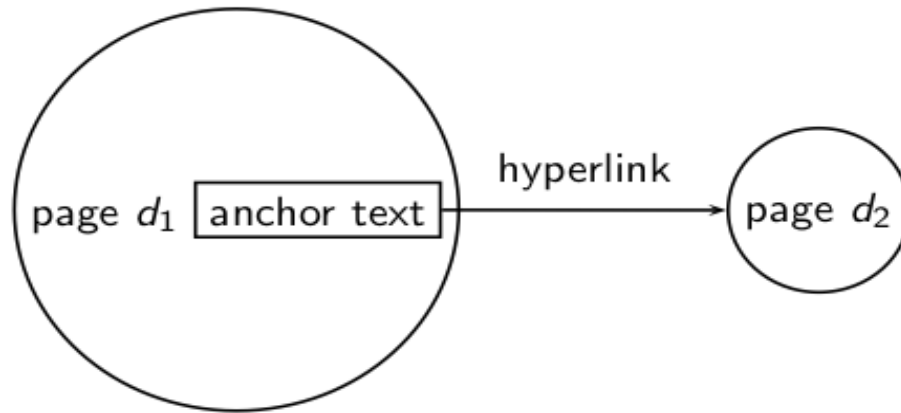
- The anchor text describes the content of d_2

Use anchor text in Search engines

- Example: Query *Bing*

  - Matches Bing's wikipedia article

  - Matches Bing's Legal page

  - Matches many spam pages

  - May not match Bing home page!

  - … if Bing home page is mostly graphics

- Searching on [text of d_2] + [anchor text $\rightarrow d_2$] is often more effective than searching on [text of d_2] only

  - In this representation, the page with most occurrences of *Bing* is www.bing.com

Anchor text *IBM* pointing to www.ibm.com

www.nytimes.com: "IBM acquires Webify"

www.slashdot.org: "New IBM optical chip"

www.stanford.edu: "IBM faculty award recipients"

wwww.ibm.com

Google bombs

- A Google bomb is a search with "bad" results due to maliciously manipulated anchor text.

Google bombs

Coordinated link creation by those who dislike George W. Bush

More Google bombs

More Google bombs

murder

About 212,000,000 results (0.17 seconds)

▶ **Murder** - Wikipedia, the free encyclopedia ☆ 🔍
Murder is the unlawful killing of another human being with "malice aforethought", and generally this state of mind distinguishes **murder** from other forms of ...
Murder (United States law) - Murder in English law - Murder (Canadian law)
en.wikipedia.org/wiki/**Murder** - Cached - Similar

Abortion - Wikipedia, the free encyclopedia ☆ 🔍
Generally, the former position argues that a human fetus is a human being ...
United States - Methods of abortion - Abortion by country - Abortion law
en.wikipedia.org/wiki/Abortion - Cached - Similar

➕ Show more results from wikipedia.org

Try query "professional hairstyle" and "unprofessional hairstyle" in Google's image search

Summary

- Part I — Computing

- Part II — Computing at SCU

- Part III —PageRank

- Computing fields are a lot of fun!

Thanks!

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