Set 10
Search Engines & SEO
Outline

• How do search engines work?
  – Basic operation
  – What makes a good one?
  – What makes it difficult?

• Web Design with search engines in mind
Search Engines – Basic Operation

- Crawler
- Indexer
- Query Engine
Crawler

• How does it find the pages?

• Does it crawl everything?

• How fast does it crawl?
The Web is a Bow-Tie

- Early study of 200 million web pages and links
  - Broder et al. 2000
- Structure of the web: a bow-tie shape
Indexer

- Parse document
- Remember
  - Whole text
  - Words
  - Phrases
  - Link text
- Builds an “inverted index”

  barista 531235, 4324, 6981, 125793, 41009, …
  burrito 344, 7173, 574527, 14513, 2451245, …
  burro 8375, 75346, 345231, 5123523, 52388, …
Query Engine

- Process text query from user
- Inverse index merges document IDs
- Return *ranked* set of hopefully relevant pages
- Ranking factors
  - 1. Query-specific
  - 2. Page-specific
  - 3. Page Genre
  - 4.
PageRank

• Original basis of Google – still important
  – Developed in 1998.
  – http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.38.5427

• Basic Model
  \[ R(w) = c \sum_{v \in B_w} \frac{R(v)}{|F_v|} \]

• Two interpretations:
  – Random walk
  – Pages voting
PageRank

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  - Random walk
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PageRank

• Who owns the PageRank patent?
  – (hint: not Google)
SEO

- Goal

- What does it consider?

- Types
• Early search engines heavily dependent on meta tags

• What to do?
  – White hat:
  – Black hat:

• Key issue: easy to _____________________
Modern search engines depend heavily on links

What to do?

- White hat:

- Black hat:
SEO 2.0

• **Machine Learning**
  – You search for “cats”, which result do you click first?
  – Learn from user clicks which they prefer
  – Smarter algorithms cluster words that “mean” the same thing

• **What to do?**
  – White hat:
  – Black hat:
Good principles

• Clear hierarchy
• Links to all pages (static), not as images
• Useful content
• Links from relevant sites
• Good title / alt / meta
• Limit dynamically generated pages (or # args)
• No broken links, < 100 links
• Use robots.txt – exclude internal search results
• Fresh content
Bad principles

- Stuff with lots of irrelevant content
- Show different version of content to crawler
- Link schemes, farms
- Hidden text and links
- Pages designed just for search engines, not users
- Automated querying
- Deception in general