How does Google search for everything?
Computer Science at Work

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How does one search for an item?

- Data must be organized in some way
- Sorting alphabetically (or numerically) is one way
  - Sorting by height – compare the two ways we sorted
  - Demo several sorting algorithms
    - Selection sort
    - Insertion sort
    - Shell sort
- There are other ways to organize data!

Sorting Network

Sort numbers (largest at bottom) using comparators in parallel
Sorting Network  
different setup for comparators

Sort numbers (largest at bottom)

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Google Search Query

1. The web server sends the query to the index servers. The content inside the index servers is similar to the index in the back of a book - it tells which pages contain the words that match the query.

2. The query travels to the doc servers, which actually retrieve the stored documents. Snippets are generated to describe each search result.

3. The search results are returned to the user in a fraction of a second.

Computer Science at work behind the scenes!

- Googlebot web crawler
  - Finds and retrieves pages
  - Gives pages to google indexer
Google is all about problem solving and writing algorithms

- Algorithms must happen fast!
- Compare the two sorting algorithms we did
- Want efficient, fast algorithms!
- No one wants to wait on a search query!
Computer Science Research at Duke

• Microscopic robots
  – assembling self organized structures
• Smart Phone surround sense App
  – Using algorithms to figure out your exact location
  – Better than GPS
• Building networks for the future
  – Large scale experimental network
• Virtual World (Classroom) with students from Duke and China

My research - Making theoretical concepts come alive – visualize and interact with!