

How does Google search for everything? Computer Science at Work

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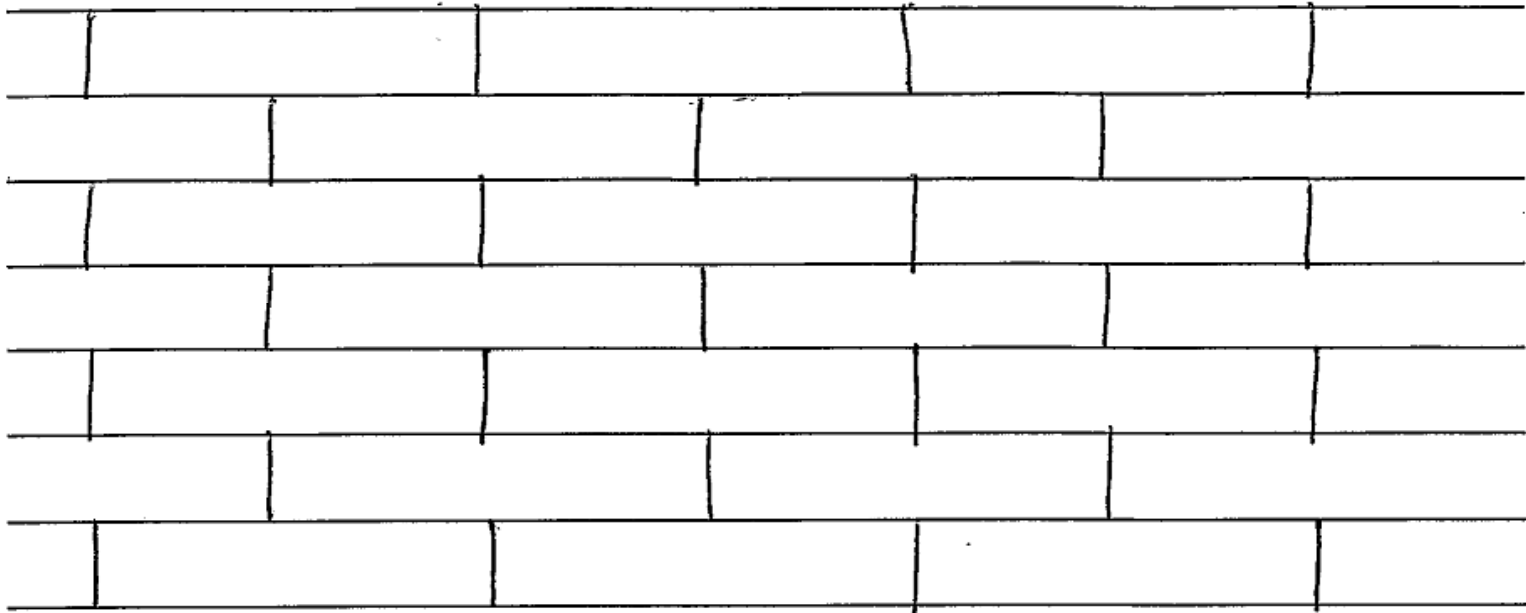


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How does one search for an item?

- 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

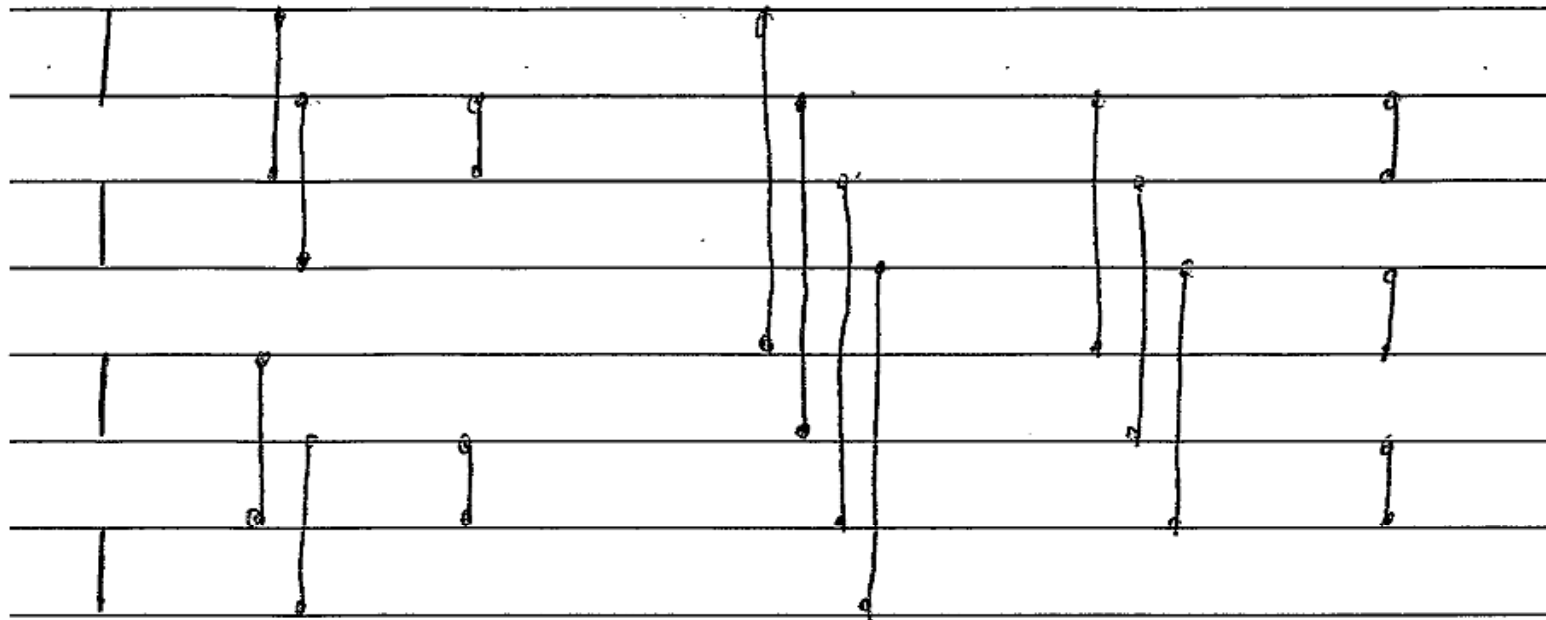


Sort numbers (largest at bottom)
using comparators in parallel

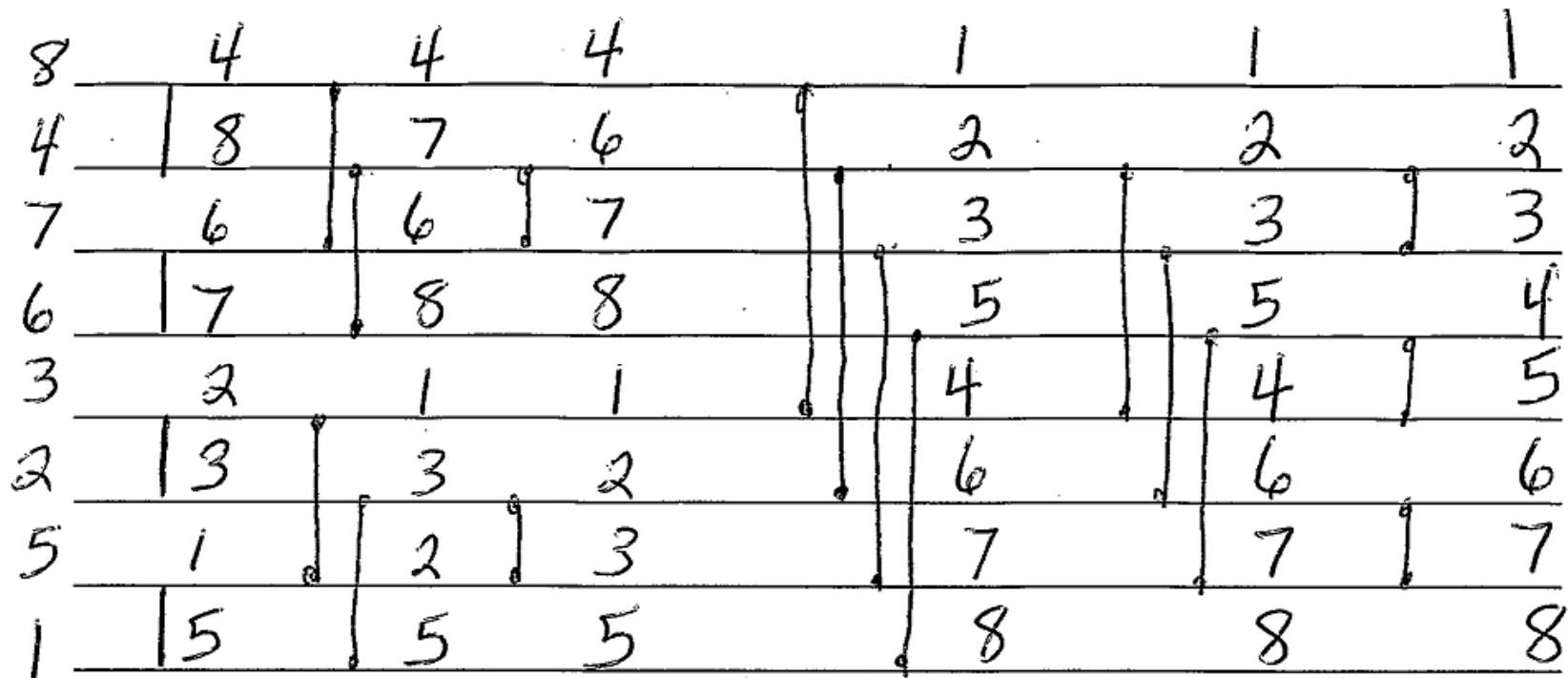
8	4	4	4	4	2	2	1
4	8	6	6	2	4	1	2
7	6	8	2	6	1	4	3
6	7	2	8	1	6	3	4
3	2	7	1	8	3	6	5
2	3	1	7	3	8	5	6
5	1	3	3	7	5	8	7
1	5	5	5	5	7	7	8

Sorting Network

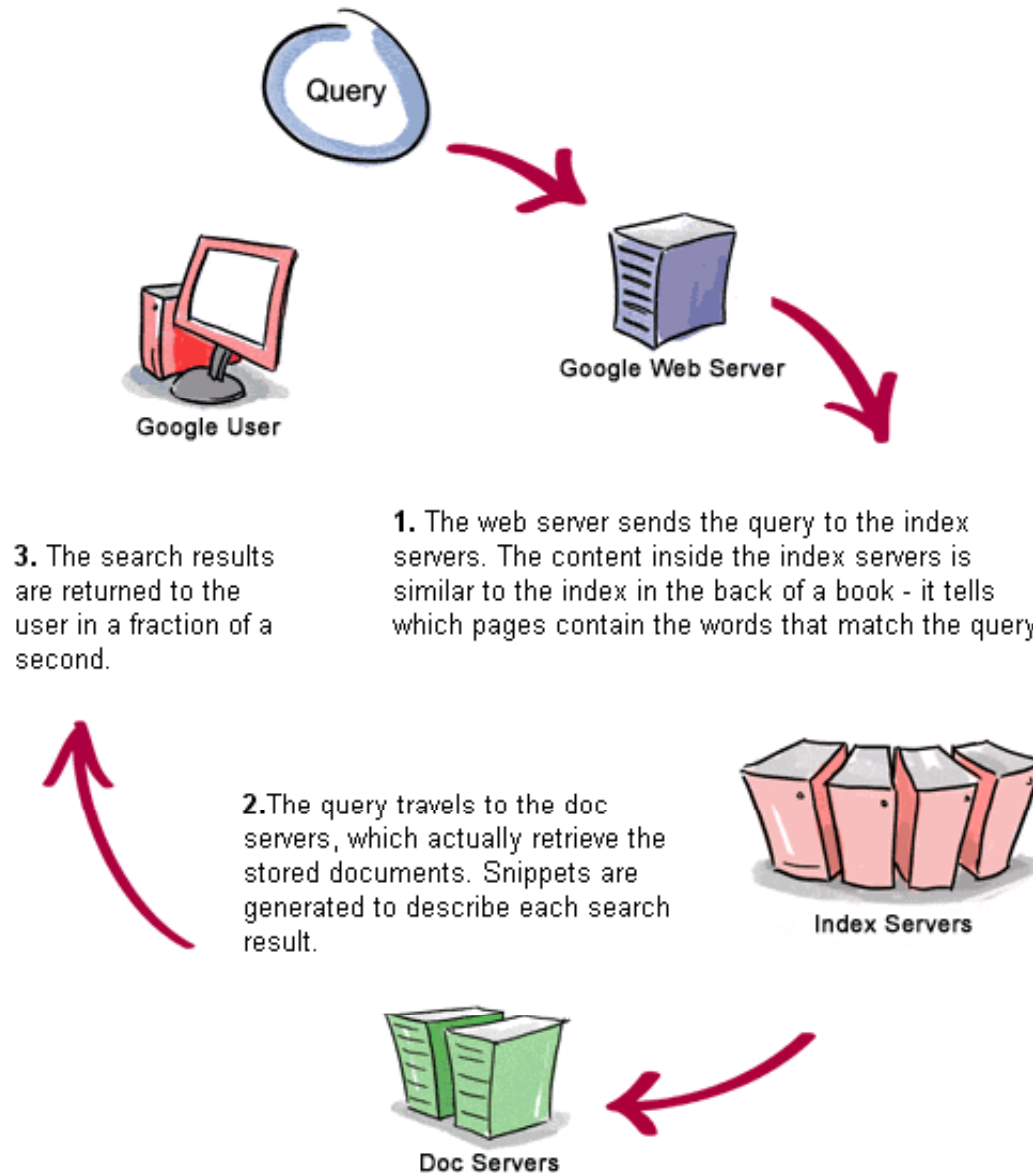
different setup for comparators



Sort numbers (largest at bottom)



Google Search Query



Computer Science at work behind the scenes!

- Googlebot web crawler
 - Finds and retrieves pages
 - Gives pages to google indexer

“how” “google” “search” “works”

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Results 1 - 10 of about 446,000,000

[How Google Works - Google Guide](#)

Feb 2, 2007 ... **Google** gives more priority to pages that have **search** terms near each other ... For more information on **how Google works**, take a look at the ...

www.googleguide.com/google_works.html - [Cached](#) - [Similar](#)

[Google Technology](#)

The heart of **Google's search** technology is PigeonRank™, a system for ranking web pages ... Building upon the breakthrough **work** of B. F. Skinner, ...

www.google.com/technology/pigeonrank.html - [Cached](#) - [Similar](#)

[Corporate Information - Technology Overview](#)

The software behind our **search** technology conducts a series of simultaneous ... The life span of a **Google** query normally lasts less than half a second, ...

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[HowStuffWorks "The Google Search Engine"](#)

The **Google search** engine allows you to find just about anything you can think of on the Internet. Learn more about the **Google search** engine.

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Internet **search** engines do your research for you. Learn how internet **search** engines like **Google work**, how internet **search** engines build an index and what ...

computer.howstuffworks.com/search-engine1.htm - [Cached](#) - [Similar](#)

[The Anatomy of a Search Engine](#)

The **Google search** engine has two important features that help it produce high That **works** out to be about 850 terabytes. Also assume that indexing a ...

infolab.stanford.edu/~backrub/google.html - [Cached](#) - [Similar](#)

Page Rank Algorithm



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[Times LIVE](#)

[Billy Ray Cyrus Raps for Miley's Twitterers](#) - 11 hours ago
Miley Cyrus rapped about leaving Twitter, so why shouldn't Billy Ray **Cyrus** rap about stickin' around? Anything Miles can do, dad can do better, right? ...

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[Are Miley Cyrus & Penelope Cruz filming with the ladies of 'Sex ...](#) -

[Examiner.com](#) - [56 related articles »](#)

[MileyCyrus.com](#) - Step Into... a [Miley](#) State of Mind

Features news, pictures, audio, video, biography, events, and information on her fan club.
[www.mileycyrus.com/](#) - [Cached](#) - [Similar](#)

[Miley Cyrus](#) - [Wikipedia, the free encyclopedia](#)

Miley Ray Cyrus (born Destiny Hope **Cyrus**; November 23, 1992) is an American pop-rock singer and television and film actress. **Cyrus** is best known for ...

[Early life](#) - [Career](#) - [Entrepreneurship](#) - [Philanthropy](#)

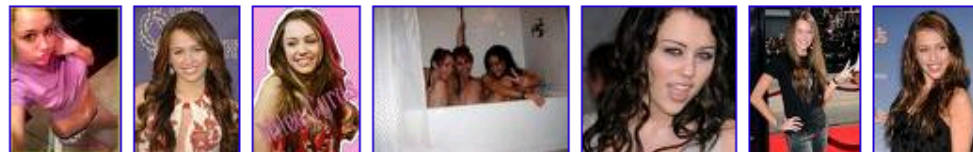
[en.wikipedia.org/wiki/Miley_Cyrus](#) - [Cached](#) - [Similar](#)

[Miley Cyrus](#)

John Mayer Endorses **Miley Cyrus'** Exit From 'The Hate-rix': The MTV News Quote Of The Day Find where **Miley Cyrus** is credited alongside another name ...

[www.imdb.com/name/nm1415323/](#) - [Cached](#) - [Similar](#)

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Correction Algorithms



compter scienc

Search

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Did you mean: [computer science](#)

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!

