Algorithm Design and Analysis

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Administrative Stuff

Lectures: Yuhui Shi

- Monday 10:10-12:00PM ???
- Attendance is expected.

Lab: Yao Zhao

- Tuesday & Wednesday

Prerequisite. CS203

Textbook. *Algorithm Design* by Jon Kleinberg and Éva Tardos.

Grades

Course grades.

- Final Exam: 40%
- Lab: 30%
- Homework: 20%
- Attendance: 10%

Office Hours

Every Teaching Week: Monday 14:00-17:00PM

Location: Room 1011, A7 Building, Zhiyuan, Nanshan

Algorithms

Algorithm.

- [webster.com] A procedure for solving a mathematical problem (as of finding the greatest common divisor) in a finite number of steps that frequently involves repetition of an operation.

- [Knuth, TAOCP] An algorithm is a finite, definite, effective procedure, with some input and some output.

> Great algorithms are the poetry of computation. Just like verse, they can be terse, allusive, dense, and even mysterious. But once unlocked, they cast a brilliant new light on some aspect of computing. - *Francis Sullivan*

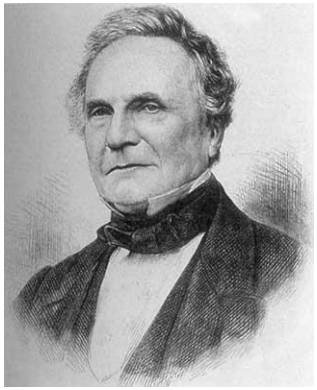
Etymology

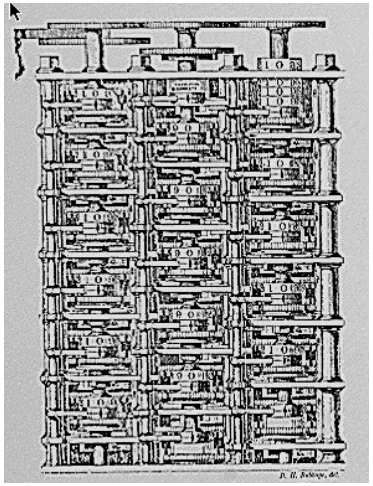
Etymology. [Knuth, TAOCP]

- *Algorism* = process of doing arithmetic using Arabic numerals.
- A misperception: *algiros* [painful] + *arithmos* [number].
- True origin: Abu 'Abd Allah Muhammad ibn Musa al-Khwarizm was a famous 9th century Persian textbook author who wrote *Kitab al-jabr wa'l-muqabala*, which evolved into today's high school algebra text.

Theory of Algorithms

"As soon as an Analytic Engine exists, it will necessarily guide the future course of the science. Whenever any result is sought by its aid, the question will arise - By what course of calculation can these results be arrived at by the machine in the *shortest time*? - *Charles Babbage*





Algorithmic Paradigms

Design and analysis of computer algorithms.

- Greedy.
- Divide-and-conquer.
- Dynamic programming.
- Network flow.
- Randomized algorithms.
- Intractability.
- Coping with intractability.

Critical thinking and problem-solving.

Applications

Wide range of applications.

- Caching.
- Compilers.
- Databases.
- Scheduling.
- Networking.
- Data analysis.
- Signal processing.
- Computer graphics.
- Scientific computing.
- Operations research.
- Artificial intelligence.
- Computational biology.
- . . .

We focus on algorithms and techniques that are useful in practice.