Introduction to Algorithms - 3rd Edition - Thomas Cormen et.al.

Chapter 1

- An **algorithm** is any well-defined computational procedure that takes some value, or set of values, as **input** and produces some value, or set of values, as **output**.
- An algorithm is a tool for solving a well-specified **computational problem**.
  - The statement of the problem gives in general terms the desired input/output relationship.
  - The algorithm describes a specific computational procedure for achieving that relationship.
- **The Sorting Problem**

  Input: A sequence of n numbers $\langle a_1, a_2, \ldots, a_n \rangle$.

  Output: A permutation (reordering) $\langle a'_1, a'_2, \ldots, a'_n \rangle$ of the input sequence such that $a'_1 \leq a'_2 \leq \cdots \leq a'_n$.
- A given input sequence is called an **instance of a problem**.
- An algorithm is said to be **correct** if, for every input instance, it halts with the correct output; an algorithm **solves** the given computational problem.
- Incorrect algorithms can be useful, if the error rate is controlled
- What kinds of problems are solved by algorithms?
  - Human Genome Project (determining sequences, storage, data analysis)
  - The Internet (finding efficient routes, search engines)
  - Ecommerce
  - Manufacturing (allocating scarce resources in most efficient way)