

# Algorithms

Why do we need algorithms? We will look at an example.

## Rock Game

The following is a description of the rock game.

- There are two players, Alice and Bob
- There are two piles of rocks, each with ten rocks
- Rules are as follows
  - In a turn you may either take a rock from one of the piles or a rock from each of the piles
  - The player who takes the last stone(s) wins

Given this setup, is there a winning strategy for Alice or Bob? This **winning strategy** may also be the key to understanding more complex, less trivial problems. For example, the winning strategy to this game can easily be applied to the alignment of two sequences.

## What is an algorithm?

- A well-defined computational procedure that takes some value(s) as INPUT and produces some value(s) as OUTPUT
- In mathematical terms, an algorithm is a function that maps every element in some input space to an element in some output space

One example of an algorithm is the sorting problem. The input to this algorithm is a sequence of integers  $A = (a_1, a_2, \dots, a_n)$ . The output is some permutation  $A'$  of  $A$  such that  $a'_1 \leq a'_2 \leq \dots \leq a'_n$ .