

A horizontal teal brushstroke with irregular, torn edges, serving as a background for the title.

# ***Introduction***

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# **Textbook**

## **Introduction to Algorithms, 3<sup>rd</sup> Ed.**

**MIT Press**

T. Cormen, C. Leiserson, R. Rivest, and C. Stein

# Evaluation

Exam 70%

Assignment 30%

# Entrance rule

4:30pm – 4:40pm: Review time

4:40pm – 5:00pm: Teaching starts; no entrance.

5:00pm: Late students can come in.

5:00pm – 6:00pm: No entrance.

## **Entrance rule**

If you want to go out during class,  
you need permission from the T/A.

When you go out, close the door silently.

# What is an algorithm?

## • What is a *problem*?

- A well-specified input and output.

## • What is an *algorithm*?

- A well-defined procedure to solve a problem.

# A problem example

## • Cooking instant noodles

### • Input

- chinese noodles,
- powder soup,
- an egg,
- green onions,...

### • Output

- Cooked instant noodles

# An algorithm example

## Algorithm

- Boil 500cc of water.
- Put chinese noodles and powder soup.
- Boil for 5 minutes.
- Put an egg and green onions.
- Boil for 1 minute.

# A computer algorithm

## • *A computer algorithm*

- A well-defined *computational* procedure to solve a *computational* problem

## • *A computational problem* example

- Computing the sum of integers from 1 to  $n$ 
  - $S = 1 + 2 \dots + n$

# Computer algorithm examples

## • Elementary school algorithm

- Compute each addition one by one from the left.
- $S = (...(((1 + 2) + 3) + 4)...) + n$

## • High school algorithm

- $S = n(n+1) / 2$

## • Are the algorithms above correct?

# Correctness of algorithms

## • Elementary school algorithm

- Obvious

## • High school algorithm

- $S = n(n+1) / 2$ 
  - $2S = 2(1 + 2 + \dots + n)$
  - $2S = (1 + 2 + \dots n-1 + n) +$   
 $(n + n-1 + \dots 2 + 1)$
  - $2S = n(n + 1)$
  - $S = n(n + 1)/2$

# Comparison of algorithms

- **Which one is better?**
  - Elementary school algorithm
  - High school algorithm

# Performance of algorithms

## • Performance of algorithms

- Running time
- Space consumption

# Performance of algorithms

## • Performance of algorithms

- Running time
  - Elementary school algorithm?
  - High school algorithm?
- Space consumption
  - Elementary school algorithm?
  - High school algorithm?

# Problem instance

## • Problem

- Computing the sum of integers from 1 to  $n$ 
  - $S = 1 + 2 \dots + n$

## • A problem instance

- Computing the sum of integers from 1 to 100
  - $1 + 2 \dots + 100$

# Class outline

## • Problem

- Why the problem?
- Problem definition.

## • Algorithm

- Description
- Correctness
- Performance