Introduction

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Textbook

Introduction to Algorithms, 3rd 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,
    - pouder 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 onion.
  - 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
    - $S = 1 + 2 \ldots + n$

Computer algorithm examples

- **Elementary school algorithm**
  - Compute each addition one by one from the left.
  - $S = (\ldots(((1 + 2) + 3) + 4)\ldots) + n$

- **High school algorithm**
  - $S = n(n+1) /2$

- **Are the algorithms above correct?**

Correctness of algorithms

- **Elementary school algorithm**
  - Obvious
- **High school algorithm**
  - $S = n(n+1)/2$
    - $2S = 2(1 + 2 + ... + n)$
    - $2S = (1 + 2 + ... n\text{-}1 + n) +$
      $(n + n\text{-}1 + ... 2 + 1)$
    - $2S = n(n + 1)$
    - $S = n(n + 1)/2$

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
    - $S = 1 + 2 \ldots + n$

- ## A problem instance
  - Computing the sum of integers from 1 to 100
    - $1 + 2 \ldots + 100$

Class outline

◌ **Problem**

- Why the problem?
- Problem definition.

◌ **Algorithm**

- Description
- Correctness
- Performance