Introduction

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Textbook

Introduction to Algorithms, 3rd Ed.

MIT Press

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

Evaluation

2 Quizzes 40%

Final Exam 30%

Assignment 20%

Programming Contest 10%

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**
  - $S = n(n+1)/2$
    - $2S = 2(1 + 2 + \ldots + n)$
    - $2S = (1 + 2 + \ldots n\text{-}1 + n) +$
      $(n + n\text{-}1 + \ldots 2 + 1)$
    - $2S = n(n + 1)$
    - $S = n(n + 1)/2$

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