

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

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%
Attendance 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,
- 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 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
 - $S = 1 + 2 \dots + n$

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