Introduction to Algorithms

Date: 3/6 (Thursday)

Instructor: 유준수

Assignment

- Read 1.1, 1.2, 2.1
- Problems:
  - 1.1절 – 1, 2, 4
  - 1.2절 – 2, 3
  - 2.1절 – 1,2,3,4

Chapter 1. The Role of Algorithms in Computing

- 1.1 Algorithms
- 1.2 Algorithms as a technology

What is Algorithm?

Example of Algorithm: Sorting

Toy Example of Sorting

Toy Example of Sorting

Correctness

1. Halt
2. Correct Output

Many area of application:

- Information Retrieval from Large DB on Internet
- Public Key & Digital Signature (RSA)
- Shortest Path Problem (Graph)
- Fast Fourier Transform (FFT)
- Machine Learning
- Deep Learning

Efficiency

- Insertion Sort:
- Merge Sort:

Efficiency Example

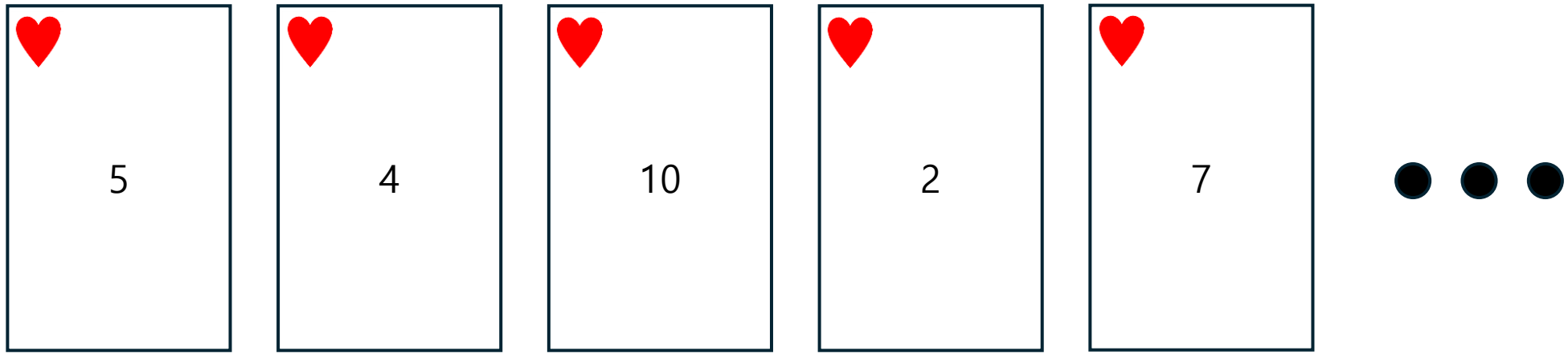
- Data size: $n = 10^7$

Name	**Computer**	**Algorithm**
Bob	A - 10^{10} $(\frac{instruction}{s})$	Insertion Sort $(2n^2)$
Alice	B - 10^7 $(\frac{instruction}{s})$	Merge Sort $(50\ nlogn)$

Chapter 2. The Role of Algorithms in Computing

- 2.1 Insertion sort
- 2.2 Analyzing algorithms
- 2.3 Designing algorithms

Card Example in Sorting

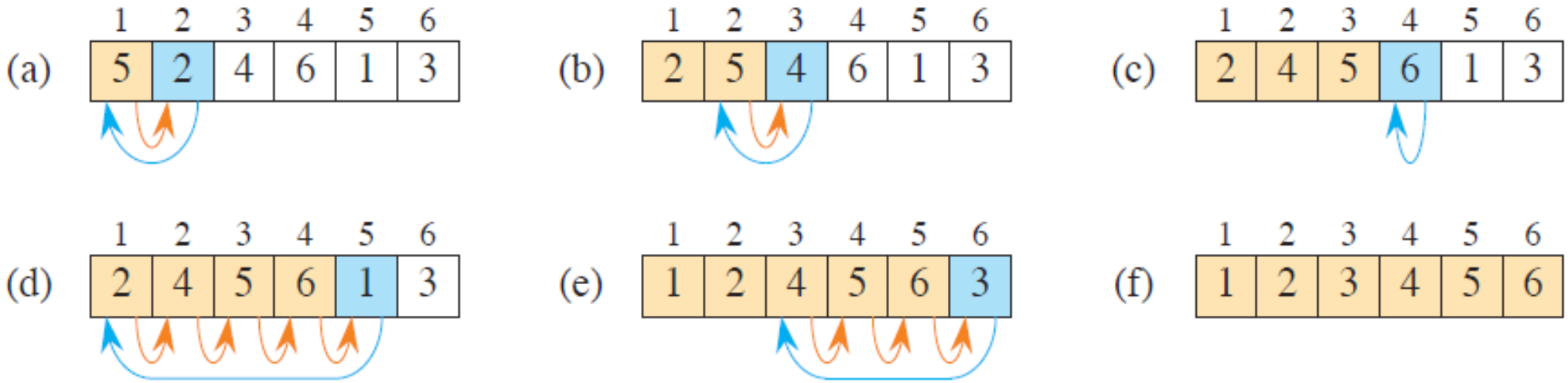



7
2
4
5
10

Mathematical Modeling: Array Representation

Insertion_Sort(A, n) - Pseudocode

Insertion_Sort(A, n) – Graphical Representation



Algorithm Correctness

- Loop Invariant: A loop invariant is a property of a program loop that is true before (and after) each iteration

1. Initialization: It is true prior to the first iteration of the loop.
2. Maintenance: If it is true before an iteration of the loop, it remains true before the next iteration.
3. Termination: The loop terminates, and when it terminates, the invariant gives us a useful property that helps show that the algorithm is correct.

Insertion_Sort(A, n) - Correctness

Question?