

# **Introduction to Data Structures**

자료구조개론

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# Instructor Information

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- Joonwon Lee
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  - Research areas
    - Computer Systems
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# Course information

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- Class hours
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- Language: **English**
- Classroom:
- Prerequisite:
  - You SHOULD know how to program in C
  - If you don't understand C Review in the next lecture, come back again after taking programming course in C (or Java, C++)
- Course website
  - <http://www.icampus.skku.edu>

# Online Lectures

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- Corona Virus made it!
- Online lectures
  - lecture note and media will be loaded on [icampus.skku.edu](http://icampus.skku.edu)
  - homework and questions will be posted on the same site
  - final exam will be rendered on the same site

# What is this course?

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- In computer science, a **data structure** is a data organization, management and storage format that enables [efficient](#) access and modification. More precisely, a data structure is a collection of data values, the relationships among them, and the functions or operations that can be applied to the data. [[Wikipedia](#)]
- Class goals
  - Learn data structure, which is a way of collecting and organizing data in a computer to perform operations on the data efficiently
  - Cover arrays, stacks, queues, linked lists, tree, graph, hashing, search and sorting algorithms

# Lecture notes

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- Textbook
  - Fundamentals of data structures in C  
by Horowitz, Sahni and Anderson-Freed (2<sup>nd</sup>, 2008)
- Lecture Notes
  - Adapt Prof. [Jinkyu Lee's](#) slides
  - which is also from Prof. [Jongwuk Lee's](#) slides.

# Grading

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- Attendance: 10%
  - You will be given **F** if you are absent **eight times** or more.
  - **Alternative attendance approval**: to follow SKKU rule
- Assignments: 20%
  - Four programming assignments
  - Academic honesty is truly needed since the penalty is severe
- Mid-term exam: 30%
- Final exam: 40%

# Grading

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- If you have any plan to be absent with reasonable reasons, please tell me in advance!
- **Cheating** will lead you to fail this course with “F” grade.
- You will be given F if you are absent eight times or more.
- The 50% A and 90% B grade guideline is merely an **upper-limit** by SKKU, not by myself.



# Tentative schedule and topics

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Week 1: Course introduction, C overview	
Week 2: Performance analysis, recursion	
Week 3: Stacks	Homework 1
Week 4: Queues	
Week 5: List	Homework 2
Week 6: Linked List	
Week 7: Trees & Mid-term exam	Homework 3
Week 8: Binary Trees	

# Tentative schedule and topics

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Week 9: Heap	Homework 4 out
Week 10: Graphs	
Week 11: Sorting	Homework 5 out
Week 12: Hashing	
Week 13: Binary Search Tree	Homework 6 out
Week 14: Binary Search Tree II	
Week 15: more BST & <b>Final exam</b>	

- To be updated

# Do we have to use English?

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- You are recommended to use English only.
- Assignment
  - Your program (C code): only in English
  - Your report: either in English or Korean
- Exam
  - All questions: written in English
  - Your answers: either in English or Korean
- Outside of the class
  - Questions through email: either in English or Korean
- In-class
  - I will answer to either languages

# Any question?

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- And, any suggestion?

# Basics of data structures

# Definition

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- Definition of data structure
  - An organization of information, usually in memory, for better algorithm efficiency
  - Queue, stack, linked list, heap, dictionary, tree, etc.
- Definition of algorithm
  - What is an algorithm?
  - What is an efficient algorithm?
    - An algorithm which spends less resources: time and space

# Definition

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- Definition of an algorithm: a finite set of instructions that should satisfy
  - 1) Input: zero or more inputs
  - 2) Output: at least one output
  - 3) Definiteness: clear and unambiguous instructions
  - 4) Finiteness: terminating after a finite number of steps
  - 5) Effectiveness (Machine-executable): basic enough to be carried out

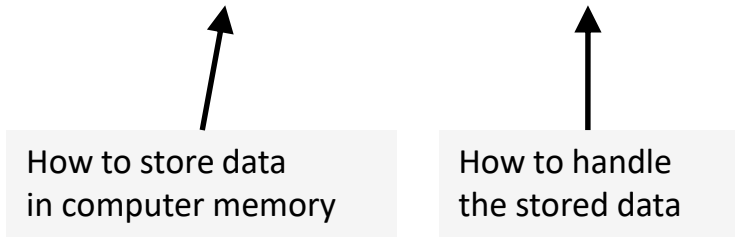


# Program

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- Program

Program = Data Structure + Algorithm



How to store data  
in computer memory

How to handle  
the stored data

# Example

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- Example 1
  - Question 1: sort 100 records.
  - Question 2: sort 1,000,000 records.

	Question 1	Question 2
<b>Insertion Sort</b>	$c_1 \cdot 10^4$ unit time	$c_1 \cdot 10^{12}$ unit time
<b>Heap sort</b>	$c_2 \cdot 10^2$ unit time	$c_2 \cdot 10^6$ unit time

# Example

- Example 2
  - Question 1: You have a lot sorted data. You frequently search for some data.
  - Question 2: You have the same data. You frequently insert and delete some data.

	Question 1	Question 2
<b>Array</b>	$c_{11} * \log n$ unit time	$+ c_{12} * n$ unit time
<b>Linked-List</b>	$c_{21} * n$ unit time	$+ c_{22}$ unit time

# Overview

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- What to learn in Data Structure
  - Some theory and data structure to efficiently store and manipulate data
  - Some algorithms and examples
- Example
  - Data structure: array, list, queue, tree, graph, sorting, hashing, heap, etc.
  - Algorithm: sorting, searching, minimum spanning tree, shortest path algorithm, etc.
  - Theory: abstract data types, performance analysis

# Overview

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- Data Structure course vs. Algorithm course

Program = Data Structure + Algorithm

Data Structure Course

Algorithm Course

Data Structure + Algorithm

Data Structure + Algorithm