Data Structures:
Course Intro & Overview

YoungWoon Cha

(Slide credits to Won Kim)

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Course Information

- Instructor: YoungWoon Cha
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- Course: Mon 16-17, Fri 11-13
- Location: AI 414

Course Objectives

- Learn the Concepts of Fundamental Data Structures.
  - used in processing data using computers
- Learn How the Concepts Are Applied.
- Learn How to Map the Concepts to Computer Programs in C.

Course Contents

- 8-10 Lectures
- 6-8 Labs (in-class), Homework
- 2 Active learning (Group Project)
- 2 Exams

The numbers of each assignment are subject to change

Course Grading Policy

- Exams   50
  - mid-term: 25
  - final: 25
- Homework: 20
- Active Learning: 20
- Attendance   10

    Total: 100

Textbook

- ## No Textbook

- ## Reference
  - Fundamentals of Data Structures in C: 2nd Edition
    - Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed (W.H. Freeman and Company)
    - Widely used, programming exercises, in English

Note

- Our School of Computing (SW Department + AI Department) has adopted self-directed learning methods in all computer-science courses (except 1st year courses).
- Professors will become more of coaches than lecturers.
- We are doing this because life is a continuous learning process, and we believe students will find, after graduation, training in school on self-directed learning very valuable.
- There are two key elements to the self-directed learning.
  - MOOC and Active Learning

MOOC (massively online open courseware)

- At least 3 weeks' classes will be conducted using MOOCs.
- Students can take the classes from anywhere any time (within one week of the posting of the MOOC).
- There will be exercise problems and assignments (due in one week).
- Students can ask questions online and receive answers within 24 hours.
- This method has been used very successfully for 6 semesters for all SW ELITE courses and SW Basic courses for all non-Computer Science students in Gachon University.

In this course, the Monday class (4pm) will be mostly held via MOOC.

Active Learning

- At least 2 weeks' classes will be conducted using an active learning method.
- The instructor will give a brief introduction to one or more topics, and the students will learn them in depth on their own, and then submit a report and present using PPT in the next class.
- ** This learning model has been used successfully for several years in the "Software Industry Seminar" course.
- ** One semester is not really sufficient to teach everything in one course, and some should be left to students to learn on their own.

The topics will be announced later.

Mentoring

- Our School of Computing (SW Department + AI Department) has also adopted mentoring programs for all the courses for 1st- 2nd year students.

- Students may ask advice from the professor or TAs after the class to makeup your progress. The student would have a second chance to earn extra incentive.

* In this course, the instructor encourages you to take this program if you're in difficult situations.

Programing Environment

- For programming Assignments, using "Visual Studio Community 2019" is highly recommended. (it's free)

Please install it on your machine by the next class.

Data Structures

- **Techniques for Organizing and Storing Data**
- **Why?**
  - To Allow Fast Access for Specific Purposes
  - "Access" means Read, Update, Delete, Copy, Move
- Many Possible Purposes -> Many Possible Techniques

What This Course Will Cover

- Main Memory Data Structures
  - lists
  - trees
  - graphs
  - hashing
- Secondary Storage Data Structures
  - trees
  - hashing
- Algorithms
  - sorting
  - tree operations
  - graph traversal

Issue of "Scale"

- Data Structures Are Important When There Are Lots of Data To Store and Access.

- The Following Questions are Meaningless.
  - What is the best data structure for (20, 15, 11, 35)?
  - What is the best data structure for (John, Mary, Paul, Nancy, Peter)?

Applications and Tradeoffs

- There Are Useful Applications for Almost Each Well-Developed Data Structure.

- There Are Tradeoffs Between Any Pair of Data Structures.

  - Almost every data structure has advantages and disadvantages.

  - There is no "best data structure for every purpose".

Lists

- **Each of the following is a list of data items. Each has different uses and different properties.**
  - **Arrays**
  - **Stacks**
  - **Queues**
  - **Linked Lists**

Fundamental Data Structures

- **Of the four types of list, arrays and linked lists (and structs) are basic data structures.**
- **All other data structures make use of them.**

End of Class