CS2351
Data Structures

General Info, Scope, Textbook, Assessment, …

General Information

- Web page:
  www.cs.nthu.edu.tw/~wkhon/ds12.html

- Lecturer: Kai (韓永楷)

- TAs: Wisely (古宗翰) Iming (陳一鳴)
  Jenny (劉向瑄) Simon (張光瑜)

- Meeting Times
  - Tutorial hour, Lab

Algorithms & Data Structures

- We need to handle problems every day
  - Transform an input into a desired output

- Algorithm: A method of solving a problem, using a sequence of well-defined steps

- Data Structures: Some ways to organize the data smartly so that an algorithm can run faster

Algorithms & Data Structures

- Ex: Given a sorted list of 7 numbers.
  Check if the number "5" is in the list
- Algorithm 1: (Scan)
  - Look at every number in the list
- Algorithm 2: (Binary Search)
  - Compare the middle number M in the list
    - Case 1: If equals, answer "YES"
    - Case 2: If M is bigger, search left half
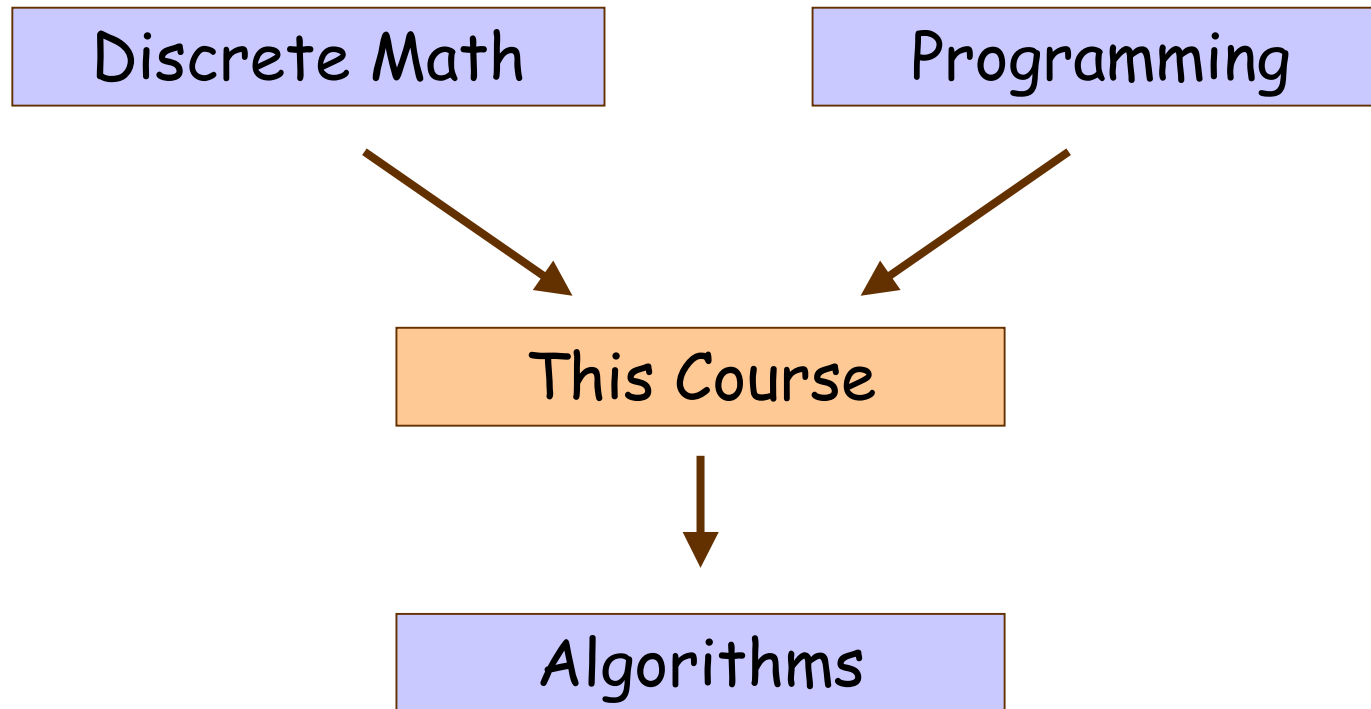   - Case 3: If M is smaller, search right half

Algorithms & Data Structures

- Both algorithms can be extended to solve a more general problem, for any sorted list of any length, and for any target number

- Question 1:

  If the length of the list is VERY long, which algorithm do you prefer? Why?

- Question 2:

  How to store the data (smartly) ?

What will we study?

- Fundamental data structures used in many algorithms

- How to design algorithms, with the help of data structure, to solve problems

  - Also, correctness + analysis

- Practice on implementing an algorithm

What will we study?

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┌──────────────────┐          ┌──────────────────┐
│  Discrete Math   │          │   Programming    │
└──────────────────┘          └──────────────────┘
              ↘                      ↙
               ┌──────────────────────┐
               │     This Course      │
               └──────────────────────┘
                          ↓
               ┌──────────────────────┐
               │     Algorithms       │
               └──────────────────────┘
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Teaching Plan

1. Basics
2. Fundamental Data Structures
   – Linked List, Queue, Stack, Tree, Graph
3. Graph Traversals
   – BFS, DFS, Connected Components, ...
4. Searching Set Data
   – Hashing, Search Trees

Textbook & References

- Textbook:
  - Introduction to Algorithms
    by Cormen and others
  - Fundamentals of Data Structures in C++
    by Horowitz and others

- References
  - Algorithms in C++, by Sedgewick
  - MIT Opencourse, Prof. Poon's notes, …

Assessments

Theory:
  3 Assignments   15%
  3 Exams   30%
Programming:
  Lab   15%
  3 Online Exams   30%
Term Project :   10%

      Total   100%

Study Tips

- Have a fresh mind in lectures & tutorials
- Don't be shy, ask questions
- Try your best to do every assignment
  - Work in groups → exchange high-level ideas → do it separately in the end

- Study the textbook, try the exercises

- Most importantly: Have fun!