CS4311
Design and Analysis of Algorithms

General Info, Scope, Textbook Assessment, …

General Information

- Web page:
  - www.cs.nthu.edu.tw/~wkhon/algo08.html
- Lecturer:
  - Wing-Kai Hon (韓永楷)
- TAs:
  - Mark (簡裕峰)   Bite (邱聖元)
  - Foga (劉富翃)   Jenny (劉向瑄)
- Meeting Times
  - Tue: 10:10—12:00   Thur: 11:10—12:00
  - Extra tutorial hours
- Our contact info & consultation hours will be posted in the course web page soon ^_^

This course is about Algorithm… So, what is an algorithm?

- We face many problems every day
  - Transform an input into a desired output
- Example: Given a list of 10 numbers, sorted in increasing order. Determine if the number "5" is in the list
  - what is the input? what is the output?
- Algorithm: A method of solving a particular problem, using a sequence of well-defined steps

Algorithms for our Example

- **Algorithm 1:** (Linear Scan)
  - Look at every number in the list

- **Algorithm 2:** (Binary Search)
  - If the list has 1 element, answer directly
  - Else, compare the middle number in the list
    - Case 1: If equals to "5", answer "YES"
    - Case 2: If bigger than "5", search left half using Algorithm 2 (but the list is now shorter)
    - Case 3: If smaller than "5", search right half using Algorithm 2 (but the list is now shorter)

Algorithms for our Example

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

- Question: When the length of the list is VERY long, say, 100000, which algorithm will you prefer? Why?

What will we study in the course?

- Look at some classical algorithms on different kinds of problems
- How to design an algorithm
- How to show that an algorithm works correctly
- How to analyze the performance of an algorithm

Teaching Plan

- Part I: Basics (~1.5 wks)
  - Growth of Function
  - Solving Recurrence
  - ➔ important in the analysis part
- Part II: Sorting & Median (~1.5 wks)
- Part III: Basic Data Structures (3 wks)
  - Hash Table, Red-Black Tree, …
  - ➔ During tutorial, time and place to be fixed

Teaching Plan

- Part IV: More Design & Analysis (~3 wks)
- Part V: More Data Structures (~3 wks)
- Part VI: Graph Algorithms (~5 wks)
    - Minimum Spanning Tree
    - Shortest Path, Maximum Flow
- Part VII: Selected Topics (~2.5 wks)
    - String Matching, RSA
    - NP-completeness, Approx Algorithm

Textbook & References

- Textbook:
  - Introduction to Algorithms, by Cormen et al.
  - Most materials are from this book
  - There is also a great set of lecture notes by Prof. BF Wang ➜ will be in our web page for download
- References
  - Introduction to Design and Analysis of Algorithms, by Lee et al.
  - Algorithms in C++, by Sedgewick
  - The Art of Computer Programming, by Knuth

Assessments

5-7 Assignments:

      Best four (total) =   37%

                 5th best =   3%

2 Midterms =   20%

Final Exam =   40%

      Total   100%

Study Tips

- Have a fresh mind in lectures & tutorials (sleep well, don't eat too much before coming :-))
- Don't be shy, ask questions
- Try your best to do every assignment

    (Can work in groups and exchange high-level ideas, but must do it yourself separately in the end)

- Study textbook, and try the exercises
- Most importantly: Have fun!