CS5371
Theory of Computation

General Info, Scope, Textbook
Assessment, …

General Information

- Web page:
  - http://www.cs.nthu.edu.tw/~wkhon/toc07.html
- Lecturer:
  - Wing-Kai Hon (韓永楷), wkhon@cs
- Tutor:
  - Shao-Chia Lu (呂紹甲), g9562643@oz
- Meeting times:
  - Tue 1410 — 1500, Fri 1520 —1710
- Consultation:
  - Send us email for appointments!!

What will you learn from this course?

- How to define a computer? **Automata theory**
- Are there problems that a computer cannot solve? If so, can we find one such problem? **Computability theory**
- For problems that a computer can solve, some problems are easy (e.g., sorting) and some are difficult (e.g., time-table scheduling). Any systematic way to classify problems? **Complexity theory**

Part I: Automata Theory

- Study very simple "computer" called automaton (plural: automata)
- Though very simple, they can solve some decision problems. E.g., is an input sequence of 0s and 1s, such as 101110101, representing a binary number divisible by 5?
- Study what kind of decision problems can be solved by automaton? What kind of decision problems cannot be solved?

Part II: Computability Theory

- Introduce a slightly more complicated computer called "Turing Machine"
  - We will show that (in some sense) Turing Machine has the same power as an ordinary computer
- Show that some problems (although sounds like easy) cannot be solved by computers

Part III: Complexity Theory

- Focus on problems solvable by computers
- Time Complexity: How difficult w.r.t. time requirement? P, NP, NP-Complete
- Space Complexity: How difficult w.r.t. space requirement? PSPACE, NL
- Problems that are outside the above classes (so that they need much more time or space to solve)

Part IV: Advanced Topics
(if we have time)

- Approximation Algorithm
- Probabilistic Algorithm
- Interactive Proof Systems
- Parallel Computation
- Cryptography

Textbook & References

- Textbook
  - Introduction to the Theory of Computation (2nd Edition), by Michael Sipser
  - We will follow very closely to this book
- References
  - Computational Complexity, by C. Papadimitiou
  - Introduction to Automata Theory, Languages, and Computation, by J. Hopcroft, R. Motwani, and J. Ullman.

Assessment

5 Assignments: Best four (@9.25%) *	37%
Remaining one *	3%
Midterm Quiz:	10%
Final Exam:	50%
Total	100%

Study Tips

- Have a fresh mind in lectures & tutorials (don't eat too much at lunch time :-))
- Don't be shy, ask questions in class
- Try your best to do every assignment
  (Can exchange high-level ideas with your classmate, but must do it yourself)
- Study textbook, and try the exercises
- Most importantly: Have fun!