Course Guide Fundamentals of Math. and Computing Sciences: Comp. Sci.

Course: Fundamentals of Mathematical and Computing Sciences: Computer Science **Instructors:** (in the order of the course schedule)

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Purpose and outline:

This course is intended to provide basic knowledges in Computer Science that would be useful for students to pursue their own research subjects in Mathematical Sciences and Information Science and Engineering.

The course is divided into three parts, each of which discusses several basic concepts in Computer Science ranging from theory of computation to advanced computer architecture.

Schedule:

Part I. Theory of Computation

Lecture 1: Oct. 5	Course Introduction and Overview of CS
Lecture 2: Oct. 19	Formal Language Theory
Lecture 3: Oct. 26	Algorithms, Complexity Theory, and Cryptography
Lecture 4: Nov. 2	Example Topic: Foundation of Machine Learning
Lecture 5: Nov. 9	Example Topic: Boosting Technique

Part II. Programming, Software Science and Engineering

Lecture 6: Nov. 16	Course Introduction and Overview
Lecture 7: Nov. 30	Type System: Why Types Matters?
Lecture 8: Dec. 7	Grammar, Semantics, Type Relation
Lecture 9: Dec. 14	Mechanical Proof Assistance System $(1/2)$
Lecture 10: Dec. 21	Mechanical Proof Assistance System $(2/2)$

Part III. Computer and Network System

Lecture 11: Jan. 4	4	Overview of the Architecture Part
Lecture 12: Jan. 1	12 (Tue)	Memory System
Lecture 13: Jan. 1	18	Parallelism
Lecture 14: Jan. 2	25	Network for Parallel Computation

References:

For Part I

- A. Maruoka, Concise Guide to Computation Theory, Springer, 2010.
- M. Sipser, *Introduction to the Theory of Computation*, PWS Publishing Company, 2012 (3rd Edition is available).
- L. Valiant, Probably Approximately Correct: Nature's Algorithms for Learning and Prospering in a Complex World, Basic Books, 2013.

For Part II

- Kamp, The most expensive one-byte mistake, ACM Queue, 9(7), 2011.
- B. Pierce, Types and Programming Languages, The MIT press, 2002.
- A. Chlipala, Certified Programming with Dependent Types, 2013.

For Part III

• TBA

Grading:

Grades will be based on the average score of homework assignments given at the end of each part.

Contact:

For technical questions and homework assignments, contact the instructor of each part via email. For the other question related this course, contact Prof. Watanabe via email.

OCW:

Check university's OCW (http://www.ocw.titech.ac.jp/index.php?lang=EN) for course notes and some (possible) changes of the course schedule