

# Selected Topics in Computing Science

廖士中

## 1 Introduction

Course Name: Selected Topics in Computing Science

Course Code: B216G004

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Selected Topics in Computing Science is a degree course for PhD candidate.

The course will cover the theory of computation, the theory of algorithms, the theory of learning, randomized computations, and other topics concerning with multifarious computations, foundations of computer science, and theoretical aspects of computer technology.

The class is organized in seminar. Each student will select a topic, and email the syllabus to the instructor. Then the student must deliver a lecture of 90 minutes presentation and 30 minutes discussion, which is based on the remediation of the syllabus by the instructor.

**Topic of little theoretical interests will be rejected.**

**Auditing this seminar requires the approval of the instructor in advance.**

## 2 Main Topics

Following is a list of topics which is subject to change.

- The Theory of Computation
  - NP-complete Problems and Proofs (NPC)
  - Probabilistic Turing Machines (PTM)
  - Interactive Proof Systems (IP)
  - Zero-Knowledge Proof Systems (ZK)
  - Probabilistically Checkable Proof Systems (PCP)
  - Tractability Theory
  - Parameterized Complexity
  - Circuit Complexity
  - Communication Complexity
  - Kolmogorov Complexity
  - Randomness in Complexity Theory
  - Logic in Complexity Theory
- The Theory of Algorithms
  - Algorithm Analysis
  - Computational Intractability
  - Approximation Algorithms
  - Randomized Algorithms
  - Parallel Algorithms
  - Online Algorithms
- The Theory of Learning
  - Computational Learning Theory (COLT)
  - Algorithmic Learning Theory (ALT)
  - Statistical Learning Theory (SLT)
  - Singular Learning Theory
- Others
  - Quantum Computation
  - Parallel Computation
  - Soft Computation
  - Computational Geometry
  - Model Checking
  - Cryptography