This course introduces some of the following topics: deterministic and non-deterministic Turing machine, time and space complexity, NP-completeness, polynomial time hierarchy, probabilistic computation, interactive proofs, complexity of counting, concrete models such as query complexity, communication complexity, formula complexity, branching programs and circuit complexity, quantum computation, complexity-based cryptography, randomness-related topics such as derandomness, pseudorandomness, extractors, random walks, etc.

Grade Descriptor:

A

EXCELLENT – exceptionally good performance and far exceeding expectation in all or most of the course learning outcomes; demonstration of superior understanding of the subject matter, the ability to analyze problems and apply extensive knowledge, and skillful use of concepts and materials to derive proper solutions.

B

GOOD – good performance in all course learning outcomes and exceeding expectation in some of them; demonstration of good understanding of the subject matter and the ability to use proper concepts and materials to solve most of the problems encountered.

C

FAIR – adequate performance and meeting expectation in all course learning outcomes; demonstration of adequate understanding of the subject matter and the ability to solve simple problems.
D

MARGINAL – performance barely meets the expectation in the essential course learning outcomes; demonstration of partial understanding of the subject matter and the ability to solve simple problems.

F

FAILURE – performance does not meet the expectation in the essential course learning outcomes; demonstration of serious deficiencies and the need to retake the course.

COURSE OUTCOMES

Learning Outcomes:

At the end of the course of studies, students will have acquired the ability to
1. understand the typical complexity classes and common techniques for various reductions,
2. prove lower bounds in concrete complexity models.
Course Syllabus:
This course introduces some of the following topics: deterministic and non-deterministic Turing machine, time and space complexity, NP-completeness, polynomial time hierarchy, probabilistic computation, interactive proofs, complexity of counting, concrete models such as query complexity, communication complexity, formula complexity, branching programs and circuit complexity, quantum computation, complexity-based cryptography, randomness-related topics such as derandomization, pseudorandomness, extractors, random walks, etc.

Assessment Type:
- Short answer test or exam: 100%

Feedback for Evaluation:
1. Quiz and examinations
2. Course evaluation and questionnaire
3. Reflection of teachers
4. Question-and-answer sessions during class
5. Student consultation during office hours or online

Required Readings:
To be provided by course teacher.

Recommended Readings:

OFFERINGS
1. CSCI5170 Acad Organization=CSEGV; Acad Career=RPG

COMPONENTS
LEC : Size=30; Final Exam=Y; Contact=3

ENROLMENT REQUIREMENTS
1. CSCI5170 Enrollment Requirement Group:
   - For students in MSc Computer Science; or
   - For students in MPhil-PhD Computer Science & Engineering; or
   - For students in UG Computer Science; or
   - For students in UG Computer Engineering

CAF