CMPT 407 - D100 Computational Complexity

Instructor(s): Valentine Kabanets

Calendar Objective/Description:
Machine models and their equivalences, complexity classes, separation theorems, reductions, Cook's theorem, NP-completeness, the polynomial time hierarchy, boolean circuit models and parallel complexity theory, other topics of interest to the students and instructor.

Instructor's Objectives:
The main goal of Complexity Theory is to answer the question: What can be efficiently computed given limited resources? This is a more "practical" version of the main question of Computability Theory: What can be computed? In this course, we will see a rich landscape of complexity classes that are used to characterize problems according to the required resources (such as time, space, randomness, parallelism). We will discuss some known and conjectured relationships among these classes, obtaining a detailed map of the complexity world. Proving the correctness of this map would involve solving some of the deepest open problems in computer science, including the famous "P vs NP" question.

Prerequisites:
CMPT 307.

Topics:
- Time and Space Complexity Classes, Nondeterminism
- Nonuniformity and Circuit Complexity
- Randomness
- Alternation and the Polynomial-Time Hierarchy
- Interactive Proofs
- Counting Classes
- Relativization and Natural Proofs
- Probabilistically Checkable Proofs
- Current frontiers in Complexity Theory
- Quantum Computing

Grading:
To be discussed in the first week of classes.

Required Books:

Recommended Books:

Reference Books:
Computational Complexity, Christos H. Papadimitriou, Addison Wesley, 1995, 9780201530827

Academic Honesty Statement:
Academic honesty plays a key role in our efforts to maintain a high standard of academic excellence and integrity. Students are advised that ALL acts of intellectual dishonesty will be handled in accordance with the SFU Academic Honesty and Student Conduct
Policies ( http://www.sfu.ca/policies/gazette/student.html ).