

**CMPT 710/CMPT 407 - Computational Complexity**  
Fall 2007

**Instructor:** Valentine Kabanets, email: [kabanets@cs.sfu.ca](mailto:kabanets@cs.sfu.ca)

**Lectures:** Tue 11:30–12:20 & Thu 11:30–13:20 in RCB 6136

**Instructor's office hours:** TBA

**Course web page:** [www.cs.sfu.ca/~kabanets/710](http://www.cs.sfu.ca/~kabanets/710)

Please refer to this page regularly for important information related to the course.

**Prerequisites:** Knowledge of discrete math and basic computability theory.

**Recommended Texts:** *Computational Complexity* by Christos H. Papadimitriou, and *Introduction to the theory of computation* by Michael Sipser.

**Course Outline:** *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.*

**Topics to be covered:**

- Time and Space Complexity Classes, Nondeterminism and NP-completeness
- Nonuniformity and Circuit Complexity
- Alternation and the Polynomial-Time Hierarchy
- Randomness, Interactive Proofs, and the PCP Theorem
- Counting Classes
- Relativization and Natural Proofs

**Marking scheme:**

4 homeworks, worth 10% each,  
1 midterm, worth 20%, and  
final exam, worth 40%.

**Academic honesty:** 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 are subject to disciplinary action by the School; serious infractions are dealt with in accordance with the Code of Academic Honesty (T10.02) (<http://www.sfu.ca/policies/teaching/t10-02.htm>). Students are encouraged to read the School's Statement on Intellectual Honesty (<http://www.cs.sfu.ca/undergrad/Policies/honesty.html>).