CS 6743 (Complexity of Computational Problems) – Fall 2008

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Lectures: TBA
Instructor office hours: TBA.

Course Web Site: `http://www.cs.mun.ca/~kol/courses/6743-f07`
All announcements will be posted on the website, as well as answers to frequently asked questions, assignments, solutions and so on. Please check it regularly.

Text: *M. Sipser: Introduction to the Theory of Computation* (second edition).

Course Description:
he goal of this course is to help students develop an intuitive feel for hardness of computational problems, and an ability to prove that intuition. What does it mean that a given problem is "hard"? In which sense is it "hard": is it memory-intensive, computation-intensive; how are these notions related? How expressive are various languages used in databases and AI, and what does it mean computationally? These are some of the questions we will explore in this course.

In paricular, we will cover the classical P vs. NP problem (is checking a solution easier than finding a solution? Nobody knows!), as well as classes of higher complexity (polynomial-time hierarchy), space classes, counting classes, randomized and circuit complexity, and descriptive and proof complexity. We will also review some computability theory and, time permitting, cover a range of advanced topics such as PCP, natural proofs (why it is hard to resolve the P vs. NP question), hardness of approximation, etc.

Topics covered:
Preliminaries; models of computation; computability; logic; the classes P and NP; completeness and reductions; relationships between central complexity classes; P versus NP; polynomial and logarithmic space classes, advice and circuit complexity; the polynomial time hierarchy and randomized complexity classes; logic characterizations of complexity classes. Also, time permitting, some advanced topics: natural proofs, PCPs, descriptive and proof complexity, hardness of approximation, cryptography and one-way functions.

Marking Scheme:
3 assignments worth 15% each, midterm 15%, presentation 10% and a final exam worth 30%.