ENGI. 9867 - Advanced Computing Concepts for Engineering

Memorial University of Newfoundland

Winter, 2009

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Lectures

Tuesday  9:00–10:15  EN-4033
Thursday  9:00–10:15  EN-4033

Suitable for  Graduate students in Computer Engineering or Computer Science or undergraduates in Computer Engineering interested in a somewhat theoretical course.

Web page  http://www.engr.mun.ca/~theo/Courses/cp/


References  •  Feldman and Harel, Algorithmics: The Spirit of Computing, 3rd Ed., Addison Wesley, 2004

Outline  The course looks a number of important questions.

•  How do I describe a computational problem? Does my program (or system) actually solve the problem it is meant to solve?
  –  Specification
  –  Verification
  –  Object orientation

•  How efficient is my algorithm? Is it maximally efficient for the problem? How hard is this problem?
  –  $O$, $\Omega$, and $\Theta$
– Complexity of algorithms
– Complexity of problems – upper and lower bounds
– The class NP
– The class NP-complete and polynomial time reductions

• **What kinds of computers are there? Which kinds of computers can solve which problems? Are there problems that no computer can solve? How can we finitely describe complex infinite sets such as the inputs to a computer program or the sentences in a human language?**
  – Finite machines
  – Regular expressions
  – Transducers and statecharts
  – Context free grammars
  – Computability and noncomputability.

It turns out that the answers to these questions have considerable engineering utility. The course deals with both the theory and the application of the theory.