# CMPUT 325 Fall 1999

## Guest Lectures Sept 28 and 30, 1999.

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For more of the same

CMPUT 474
January 2001
Instructor: Joseph Culberson

When you master this material, it will forever change the way you practice computing.

From the preface of Reference:
*Fundamentals of the Theory of Computation*
Raymond Greenlaw and H. James Hoover

http://www.cs.ualberta.ca/~joe/

## Some Computing Science Questions

- What is Computation?
- What is the simplest model of computation?
- How do various models relate — in terms of what can be computed and how efficiently?
- What are the theoretical limits of computation?
- What are the physical limits?
- What are the practical limits?
- How should we define a computational problem?
- Can we prove some problems are hard to compute for all possible programs?
- How can we classify problems as to how hard they are to compute?

CS and the BIG questions

- Is the underlying foundation of our universe computational?
  Aristotle, Newton, Lovelace, Einstein, Turing, Feynman
- Is computation sufficient to explain intelligence and consciousness?
  Babbage, Lovelace, Turing, Searle, Minsky, Penrose
- Is evolution a computational process?
  Holland, Kaufmann

Of course there are many other famous and not-so-famous scientists and philosophers who have contributed to these queries. I have only listed those that popped into my mind in the two minutes devoted to this.

And there are infinitely many more questions, many of which we doubtless do not yet know how to ask.

If we do not understand the simpler questions, if we do not develop a clear understanding of the limits and nature of computation, then any attempt to answer these big questions is just so much babble.

Where do we start? Where do we go after?

**CMPUT 204** In this course we touch on models, focus on algorithms design and analysis and lower bounds, and complete with a first look at complexity classes P and NP and reductions.

**CMPUT 304** A more advanced algorithms design course with topics varying somewhat according to instructor.

**CMPUT 474** A more formal approach to models, Chomsky hierarchy, computability and complexity.

**CMPUT 3XX** (Proposed) Techniques for Combinatorial Computing, enumeration, generation and isomorphism.

**CMPUT 366 and 466** Artificial Intelligence in many aspects.

We are trying to modify our computing science curriculum to provide a path for those few who are interested in scientific aspects of computing.

We also wish to ensure that graduates in Computing Science see some of the scientific aspects at least once.

With a little luck perhaps we can convince a few of you to contribute to the study of the big questions.