Philosophy xx/Info xx

Philosophy of Computing

Course designed by Sara Bernstein (sara.bernstein@duke.edu)

What is a computer? How is a computer different from a calculator? Should we consider the human mind or the universe to be a computer? What is it for a computational problem to be solvable? What are the practical and theoretical limits on computability? What is the relationship between hardware and software? Can a computer realize a human mind? Could a computer ever be conscious? This course will examine these and other questions about the philosophy of computing.

Requirements: class participation (30%), one term paper (50%), one robot (20%)

Schedule:

Session 1: Introduction to the Philosophy of Computing

- Matthias Scheutz, "Philosophical Issues about Computation"
- Alan Newell and Herbert Simon, "Computer Science as Empirical Inquiry: Symbols and Search"

Session 2: What is a Computer?

- Vlatko Vedral, *Decoding Reality*: *The Universe as Quantum Information* (excerpt)
- Seth Loyd and Y. Jack Ng, "Black Hole Computers"

Session 3: Are Humans Computers?

- John Searle, "Is the Brain a Digital Computer?"
- Jack Copeland, "Are Humans Computers"?

Session 4: The Church-Turing Thesis

- Alan Turing, "Computing Machinery and Intelligence"
- John Haugeland, "Computer Architecture" from *Artificial Intelligence: The Very Idea*

Session 5: Limits on Computability: Physical Limits

- Scott Aaronson, "Why Philosophers Should Care about Computational Complexity"
- Charles H. Bennett and Rolf Landauer, "The Fundamental Physical Limits of Computation"

Session 6: Limits on Computatbility: The P/NP Problem

- Lance Fortnow, "The Status of the P versus NP Problem"
- Richard Beigel and Bin Fu, "Solving Intractable Problems with DNA Computing"

- Optional: Apostolos Doxiadis and Christos Papadimitriou, "Incompleteness" from *Logicomix*

Session 7: Limits on Computability: NP-Completeness and the Travelling Salesman Problem

- "Challenges" from William J. Cook, *In Pursuit of the Travelling Salesman: Mathematics at the Limits of Computation*
- "What is Computable?" from John MacCormick, *Nine Algorithms that Changed the Future*

Session 8: Computer Ethics

- Wendell Walach, "Moral Machines. Contradiction in Terms or Abdication of Human Responsibility?"
- JH Moore, "Are There Decisions Computers Should Never Make?"

Session 9: Quantum Computing

- Amit Hagar, "Quantum Computing"
- Rolf Landauer, "The Physical Nature of Information"

Session 10: AI: Computing versus Understanding

- John Searle, "Minds, Brains, and Programs"
- David Chalmers, "Subsymbolic Computation and the Chinese Room"

Session 11: Good Old Fashioned AI ("GOFAI") and its Limits

- John Haugeland, "Semantics" from *Artificial Intelligence: the Very Idea*
- Daniel Dennett, "Cognitive Wheels"

Session 12: New-Fangled AI ("NFAI")/ ROBOT-BUILDING DAY!

- Rodney Brooks, "Intelligence without Representation"
- Valentino Braitenberg, *Vehicles*

Session 13: The Relationship between Computing and Hardware

- Hubert Dreyfus, "The Role of the Body in Intelligent Behavior" from *What Computers Still Can't Do*
- John Haugeland, "Mind Embodied and Embedded"

Session 14: The Singularity

- Ray Kurzweil, excerpt from *The Singularity is Near*
- David Chalmers, "The Singularity: A Philosophical Analysis"