Background/Motivation

- How much energy does it take to compute?
  - depends on how much information you discard
- Thermodynamics of Computation
  - Feynman handout from last week
  - “The Thermodynamics of Computation”
- Easy observation: Reversible = Low Power
- Interesting claim: Reversible = High Performance
  - “Reversibility in Optimally Scalable Computer Architectures”
  - What’s wrong with this paper??

Reversible Logic

- SCRL (Split-Level Charge Recovery Logic)
- Developed right here at M.I.T.
- Guaranteed to mess with your head
- Two handouts:
  - Chapter 4 from Saed Younis' Ph.D. Thesis
  - (most of) Chapter 4 from Carlin Vieri's Ph.D. Thesis
- Key concept:
  - Must be able to "uncompute" every logic gate!!

Reversible Architecture

- Simple approach: Cellular Automata
  - Lots of reversible CA exist
  - Lots of universal CA exist
  - Some are both!
  - “A Scalable Reversible Computer in Silicon”
- More direct approach: Reversible Processor
  - Guaranteed to mess with your head even more
  - Pendulum: Chapters 8,9 of Carlin Vieri’s Ph.D. Thesis
  - All instructions must be reversible
  - Must be able to run programs forwards or backwards