Research vs Scholarship

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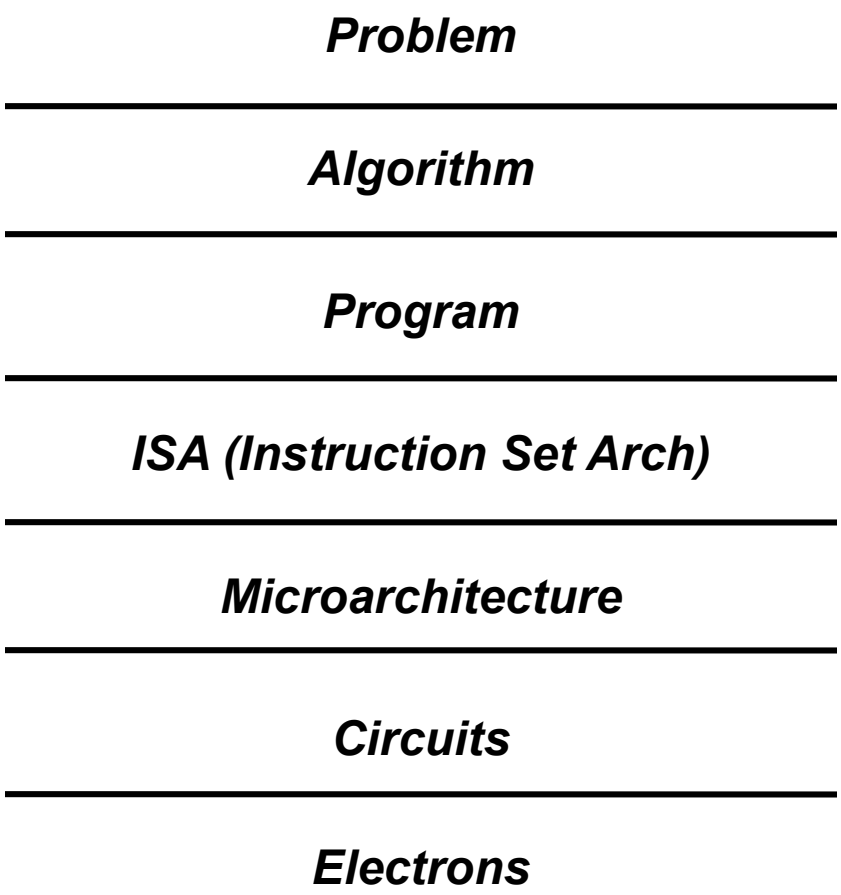
What I want to do today

- ***Visions of the future***
- ***Research or Scholarship***

Before I do any of that, Uri's slide

- *The slide said: 100x from process, 20x from uarch*
- *A data point: DEC EV4 to EV8*
  - *Performance increased by 55x*
  - *Frequency increased by 7x*
  - *Where did the other 55/7 come from?*


Problem
Algorithm
Program
ISA (Instruction Set Arch)
Microarchitecture
Circuits
Electrons

Room at the top, requirements at the bottom

- ***At the top:***
  - ***Leiserson et.al. white paper***
- ***At the bottom:***
  - ***run-time unit (Per said it yesterday)***

What else

- *On the chip: One ISA, multiple microarchitectures*
- *Multiple Single threads*
  - *Amdahl*
  - *Critical sections*
  - *Lagging threads*
- *Accelerators (I called them Refrigerators)*
  - *Embracing the whole transformation hierarchy*
  - *Plenty of transistors*
  - *Powered on when you need them, off when you don't*
- *Can we partition data better*
  - *The Dick Sites experiment. EV5 running at 6%*
  - *And a flag inserted by the compiler when the unit is dead*

Research or Scholarship

- ***Andre said: I need to understand what I am doing***
- ***UT Discussion:*** ***Research in the undergraduate curriculum***
  - ***Engineering means something different than everyone else***
- ***The two-level branch predictor***
  - ***It wasn't the history, it was what we did last time that history***
- ***HPS***
  - ***Tomasulo had out-of-order and it broke the ISA***
  - ***Separate the ISA from the microarchitecture***
  - ***Tomasulo did floating point out-of-order***
  - ***More micro-ops than just floating point***

  AND, some of our implementation was bad!
- ***Machine learning → Compile-time branch prediction***

Is Engineering out of step?

Do we value understanding,
or do we value the artifact?

Thank you!