Welcome to CSE 502

Introduction

Today's Lecture

- Course Overview
- Course Topics
- Grading
- Logistics
- Academic Integrity Policy
- Homework

Course Overview (1/2)

- Computer Architecture is
  … the ***science*** and ***art*** of selecting and interconnecting hardware and software components to ***create computers*** …

- Computer Architecture is an umbrella term
  - *Architecture*: software-visible interface
  - *Micro-architecture*: internal organization of components

- This course is mostly about ***micro-architecture***
  - What's inside the processor (CPU)
  - What implications this has on software

Course Overview (2/2)

- This course is hard, roughly like CSE 506
  - In CSE 506, you learn what's inside an OS
  - In CSE 502, you learn what's inside a CPU
- This is a project course
  - Learn why things are the way they are, first hand
  - We will "build" emulators of CPU components
- "Hard" doesn't mean what you think it means
  - Especially for PhD students: don't listen to "seniors"

Why Study CompArch (1/3)

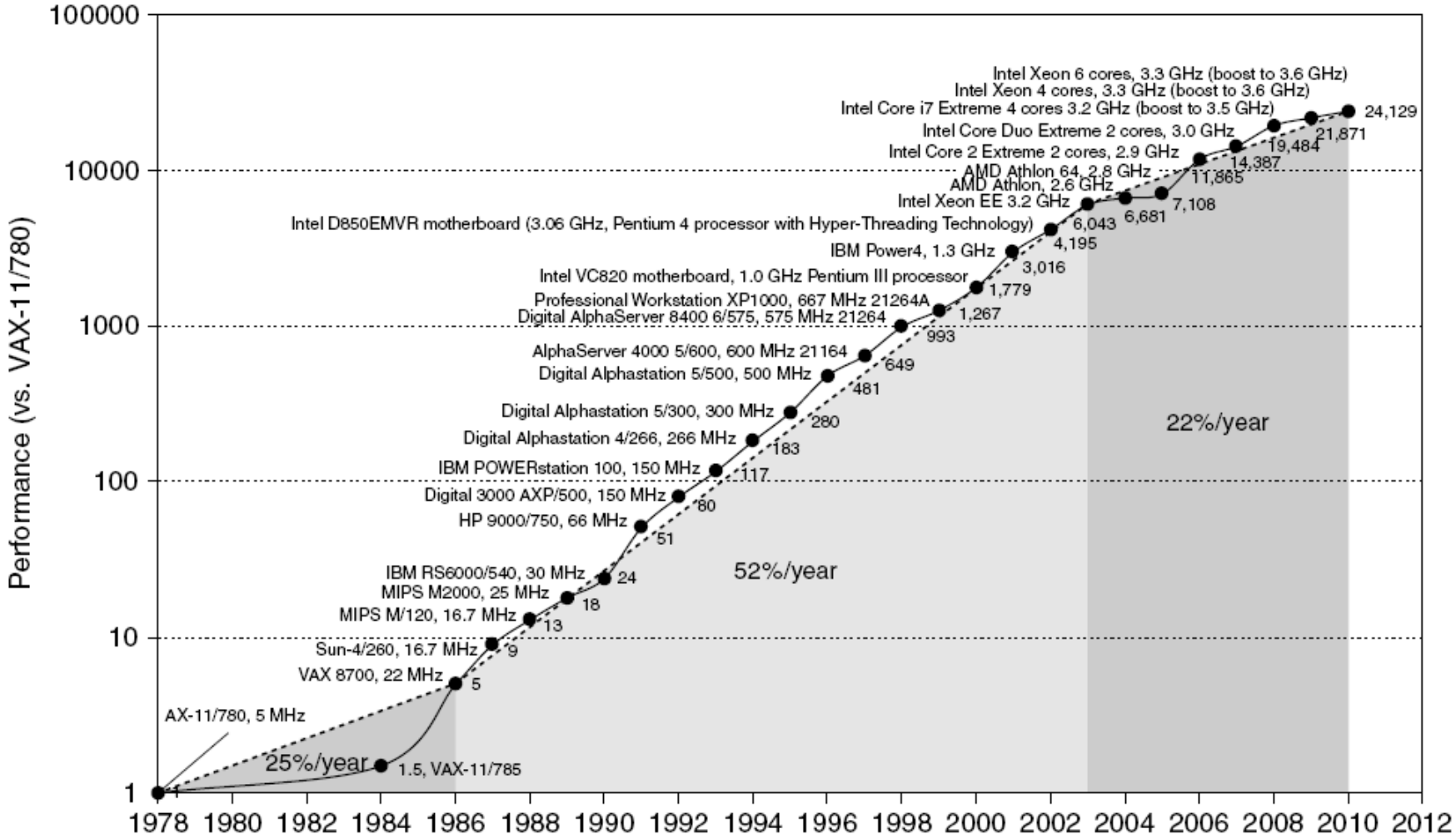
- You need one more qualifier/graduation requirement

× ***Bad answer!***

- You want to become a computer architect
- You want to learn what's inside a processor
  - Because you're curios (and there is no computer w/o a processor)
  - To write better/faster application code
  - To write system software (OS, compiler, etc.)
- Computer architecture is cool and intellectually fascinating
  - What is the most complex man-made device?
    - There are billions of transistors in a modern processor chip

✓ ***Better answer!***

Why Study CompArch (2/3)



Why Study CompArch (3/3)

- Sources of performance improvement
  - Improvements in semi-conductor technology
    - Faster transistors
    - More transistors
  - Improvements in computer architecture
    - Architects turn resources into speed/power savings/features

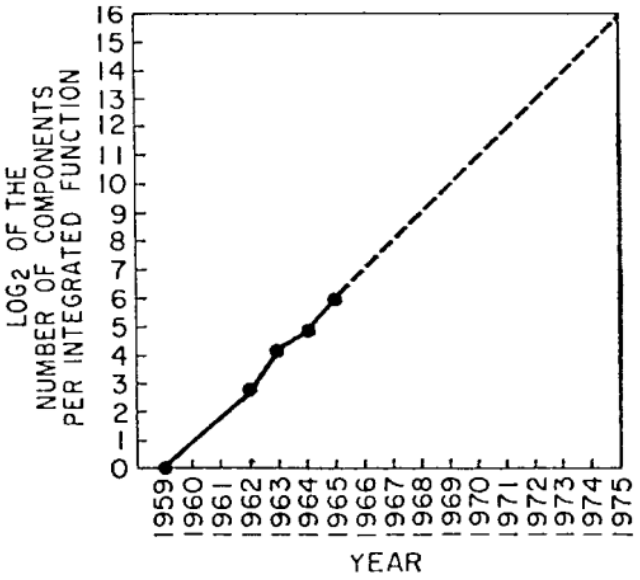
Moore's Law

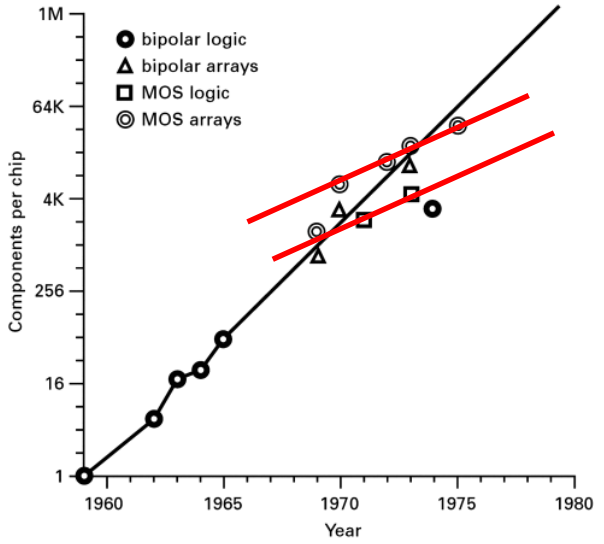
- 1st Moore's Law (1965)

  "The complexity for minimum component costs has increased at a rate of roughly a factor of two per year. Certainly over the short term this rate can be expected to continue, if not to increase."

- 2nd Moore's Law (1975)

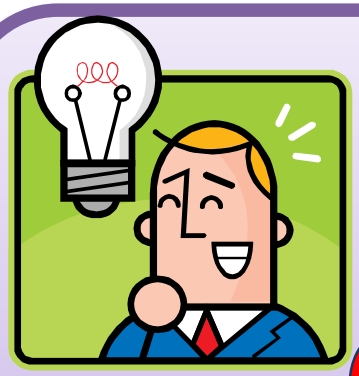
  "The new slope might approximate a doubling every two years, rather than every year"





Moore's law now used to describe exponential tech. growth

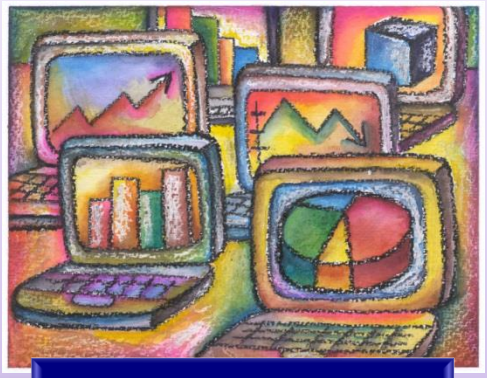
Hardware Design Process



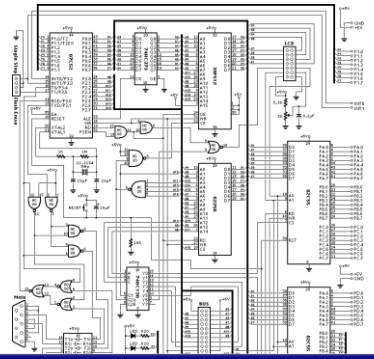
Conceptual Design

Behavioral Implementation

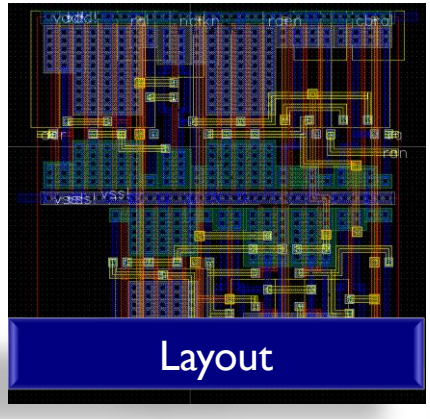
CSE 502



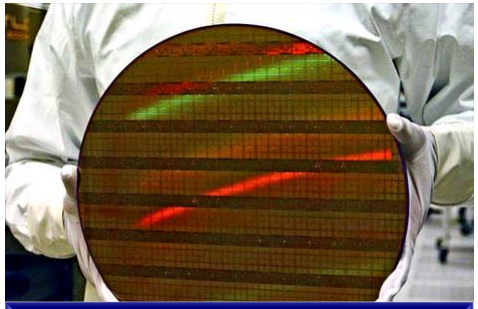
Evaluation



Structural Implementation



Layout



Manufacturing

Packaging

Course Topics

- Intro/Review
- Instruction Decode
- Pipelining
- ***Memory Hierarchy***
- ***Processor Front-end***
- ***Execution Core***
- Multi-[socket(SMP,DSM)|thread(SMT,CMT)|core(CMP)]
- Vector Processing and GPUs

Will devote most attention to items in ***bold***

Grading (Standard Option)

	Due Date	Points	Grading	Required?
1 Homework	Mar 26	10	Curve 0 to 100	No
2 Warm-up Projects	Feb 14/Mar 7	20	Absolute Value	No
1 Course Project	Last class	100	See below	Yes
1 Final Exam		40	Absolute value	No
Participation		10	Curve 0 to 100	No

Course Project	Points
5+ stage, Direct-mapped Caches	50
5+ stage, Set-Associative Caches	60
Super-Scalar, Set-Associative Caches	70
Super-Scalar, Out-of-order, Set-Associative Caches	80
Any of the above +TLBs	+10
Any of the above +Branch predictor	+10

Without curve, need 100 points to get an A

Grading (Research Option)

- If you are…
  - Pursuing a PhD
  - Pursuing an MS thesis
  - Planning to take 523/524 with me
- You may select a ***research*** option for the grade
  - ***Only*** available with instructor's approval
- When selecting this option…
  - Must work ***alone*** on everything
  - Attain ***at least*** 60 points of the Standard Option
  - Grade will be based on ***subjective*** research progress

Note: Of the two, this is the ***harder*** option

Logistics (1/3)

- Project milestones
  - There are ***no*** official project milestones
  - If ***you*** need milestones, send me a milestone schedule
    - I will deduct 5 points for each milestone you miss
- Books
  - Recommended for reference, not required
    - Does not mean you shouldn't get them
    - Do not pirate books
  - Modern Proc. Design: Fundamentals of Superscalar Proc.
  - Computer Architecture (Hennessy & Patterson)

Logistics (2/3)

- Working in groups
  - Permitted on everything except Final
  - Groups may be of any size
    - Points deducted on group work are multiplied by group size
    - Great opportunity or Rope to hang yourself – you pick
- Attendance
  - Optional (but highly advised)
  - No laptop, tablet, or phone use in class
    - Don't test me - I ***will deduct*** grade points

Logistics (3/3)

- Blackboard
  - Grades will be posted there, nothing else
- Course Mailing List
  - Subscription Is ***required***
    http://piazza.com/stonybrook/spring2019/cse502/home

Academic Integrity Policy

- You may...
  - Discuss assignment, design, techniques
- You may ***not***...
  - Share code outside your group
  - Use any code not distributed as part of project handouts
    - Exceptions are possible, but must receive explicit permission
- You ***must*** declare group composition...
  - Explicitly via email to TA and instructor
  - Explicitly for each assignment
  - At most ***five*** days after assignment handout

Homework

- Independent hacking projects

- If interested…
  - "Pick up" assignment during office hours
    - Come with all group members
  - If can't make it during office hours
    - Schedule an appointment

Questions?