382M Lecture 1

OUTLINE
Motivation/tech trends
Admin
Student pictures and questionairs
Course overview

Happy to be teaching class

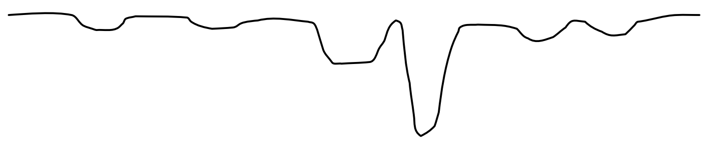
o got into CS b/c wanted to know how computers work
(heard it was a bunch of binary switches...)

o quantitative field
not just religious wars
if you have a good idea, someone will want to build it and make $'s
v. history or literature or philosophy -- we can argue what Nietze meant
over beer forever (I'm sure they would argue that that's what
is great about the field; not my cup of tea)
science == test hypothesis that can be proven wrong

o excellent text
well written, good arguements to provide intuition about ideas
many ideas seem simple -- they are once they are well explained.

second edition much different than first edition
less basic material, more advanced material

will add a bit of outside reading
o new book has much of what I would add
o will read a paper here and there for interesting and recent ideas
o project will provide opportunity for more advanced work
model



Text = baseline, etc

Motivation: Technology

3 ideas
1. things are changing fast
2. things are changing at different rates
3. --> changing technology trade-offs

lesson 1: Up and to the right

Microprocessor performance:
*Figure 1.1 from text*
1.54x per year --> 8x in 5 years

Moore's law story – it was basically a joke. Someone asked how many transistors fit on a chip in 5 years; and he answers that it will double every year or year-and-a half. Has held for 25+ years (see additional reading in HW).

o was 1.35 per year unil 1980
--> *architecture* innovations (RISC) --> extra 20% per year

--> in the 12 years since RISC processors hit the street get a "free" 8x
I have an ultrasparc on my desk
without the ideas in this class, it would be a SPARC 2

Storage capcity
disk 60%/year 4x/3 years *tech trends slide*
memory 60%/year 4x/3 years *tech trends slide*

--> Makes life more interesting for rest of CS
(you can try more ambitious stuff)
e..g suppose you file thesis in 5 years
processor: 100 SPECInt95 (e.g. 100x a “SPARC 10/40 w 128MB of memory”)
1500 SPECInt92 (e.g. 1500x a VAX)
memory 1 GByte
disk: 100 GByte

Makes life exiting for rest of CS
(v. mech eng -- bridge design changes more slowly)

Example: the internet is interesting b/c backbone can run at 10's-100's Mbits
and because switches are cheap and fast

lesson 2: Things change at different rates

Processor performance: 2x/2 years
Disk performance: 1.4x in 10 years
DRAM perf: 1.4x in 10 years

--> Need to find clever ways to hide performance
of disk and dram

lesson 3: Changing trade-offs

Idea that was good 10 years ago may be wrong today

example VAX built when 64KB was a lot of memory
--> design for dense encoding
today, memory costs 1000x less
--> design for high performance
-->DEC abandons VAX architecture
tomorrow, programs transmitted over network and loaded on-the-fly
→ design for code density????

example: patterson Slide Lecture 1 Slide 9
Supercomputer, Mainframe, Minicomputer on 35%/year curve
Workstation on 55%/year curve
(b.c on one chip)
--> microprocessors overtake

<show patterson fishes slides – patterson lecture 1 slides 2-4>

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ADMIN
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Text: H&P 2nd edition (not first edition!)
+ additional papers I will hand out or put on web

Grading

- 10% participation
- 30% quizzes
  - low pressure: 1 1/2 hour exam; give you 3 hours
  - <date> 2.106 Taylor 6-9 PM
  - <date> 2.106 Taylor 6-9 PM

    Lecture that day will be Q&A
- 20% Homework (5 HW's; work in pairs)
- 40% project ( work in pairs)

Project

- idea: do some research
- focus: good scientific method, quantitative results
- format: several midterm checkpoints, oral and written
  - presentations
  - (similar to conference)
- talk about this more later

Lectures

- 1 minute review
- 1 minute outline
- 20 minute lecture
- 3 minute admin
- 24 minute lecture
- 1 minute summary

admin in middle b/c attention spans
outline/summary important to presentations

philosophy -- write on board instead of slides (or I'll go too fast)
- -- encourage discussion
- -- feedback
  - I'll hand out 3x5 cards in a month or so
  - feedback welcome any time

<OPTIONAL>
If enrollment a problem

- first priority to CS grad students
- then to EECS grad
- then CS/EECS undergrad

then everyone else

Homework 1: should be review

<pass it out>

Class pictures -- I'm bad at names

questionare -- name
e-mail
major
year in grad school
advisor
research interests

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COURSE OUTLINE
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Review: ch 1-3 (fast)
- Tech trends
- performance metrics
- instruction sets
- basic pipelining

advanced ILP, pipelining (ch 4)
- dynamic branch prediction
- superscaler, superpipelined
- limits of ILP

memory hierearchy (ch 5)
- caches, memory banks, vector processing...

<exam 1>

I/O, storage (ch 6)

Networks, Interconnect (ch 7)

MPPs (ch 8)

<exam 2>

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SUMMARY
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1. up and to the right!
2. at differnt rates
3. changing trade-offs