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~~2~~  
~~3~~  
~~4~~  
~~5~~  
~~6~~  
~~7~~  
~~8~~  
~~9~~  
~~10~~ pieces of advice I wish my  
PhD advisor had given me

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With great affection and apologies  
to my advisors



Mischa Schwartz, EE Department,  
Columbia University



Yechiam Yemini  
CS Department  
Columbia University

and a disclaimer.....

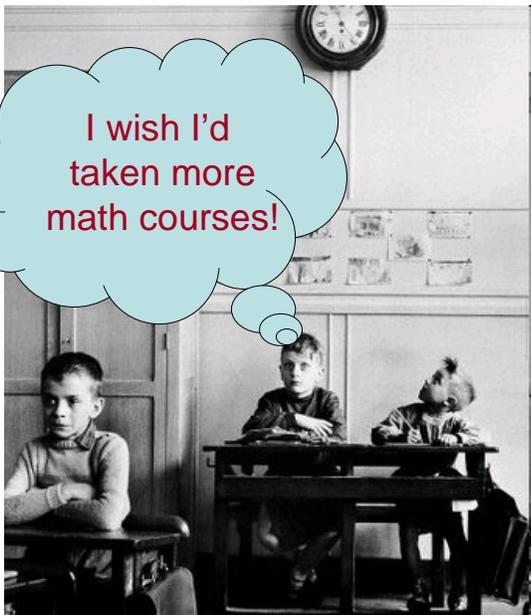


**#1**

## study broadly

***Take math courses!***

- ❑ every math course I've taken has been valuable
- ❑ won't have time later
- ❑ research fields draw increasingly on math as they mature
- ❑ theory is timeless!



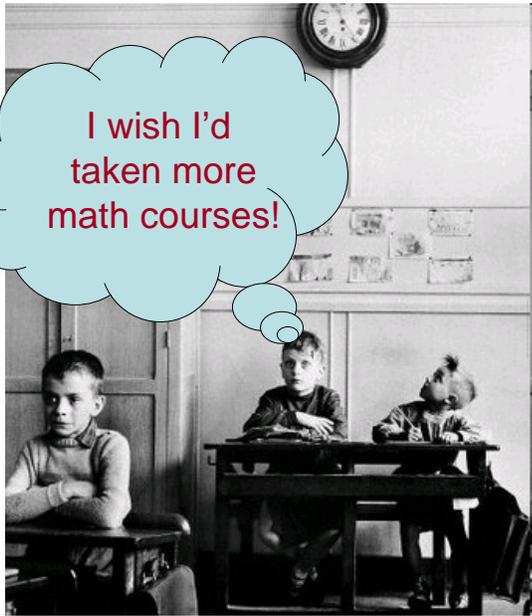
**#1**

## study broadly

***Important courses outside CS***

- ❑ signal processing
- ❑ control theory
- ❑ information theory
- ❑ nonlinear optimization
- ❑ stochastic processes
- ❑ game theory
- ❑ domains: systems biology, economics,...

# #1



I wish I'd  
taken more  
math courses!

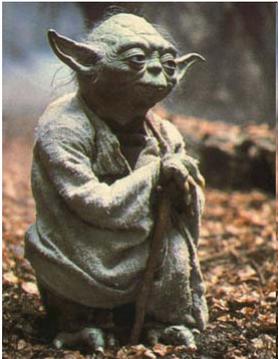
## study broadly

- ❑ you will never again have so much “relaxed” time to study, learn, think

*Sorry for that piece of bad news... but it's true*

# #2

## Choosing, defining a research problem



A fool can ask more questions in a minute than a wise man/woman (or a Yoda) can answer in a lifetime

pick your problems carefully!

- ❑ what's the fundamental issue you're solving?
- ❑ will the problem be of interest five, ten years from now?
- ❑ focus on fundamentals in a world with an increasingly short attention span

- QoS
- multicast
- congestion control
- P2P
- sensor networks
- energy

## Choosing, defining a research problem

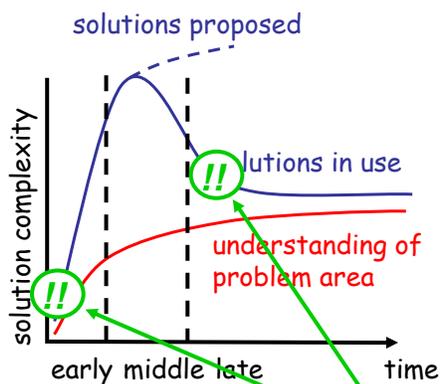


Wisdom of crowds?

*There are lots of smart people out there!*

- ❑ avoid crowded areas unless you have a unique talent, viewpoint
  - ❖ low-hanging fruit has been picked
  - ❖ researchers working on “next big thing” are not in the crowd
- ❑ take risks (it's *research*)

## Choosing, defining a research problem



[adapted from Hluchyj 2001]

*maximum impact / mindshare*

- ❑ complexity, sophistication are themselves not of interest
- ❑ simple is sometimes harder!

## Choosing, defining a research problem

solution space



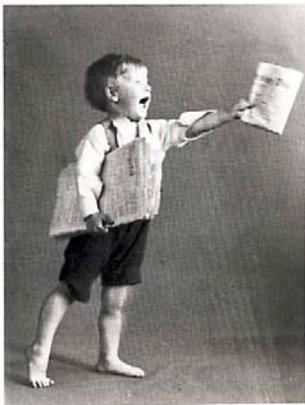
### avoid point solutions

- ❑ insights that cut across solution space vs point solution
- ❑ what broader conclusions can be drawn from your work?

 You are here (but shouldn't be)

## Publishing

#3



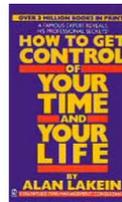
- ❑ publish where you will get mindshare, *impact*
  - ❖ there *is* life beyond sigcomm, infocom
- ❑ quality over quantity:
  - ❖ avoid LPUs
  - ❖ 1 widely-read/referenced paper >> K mediocre papers
- ❑ PhD thesis != magnum opus
- ❑ don't be driven by conference deadlines
- ❑ don't submit just to get reviews

## Time: your most precious resource #4



Time

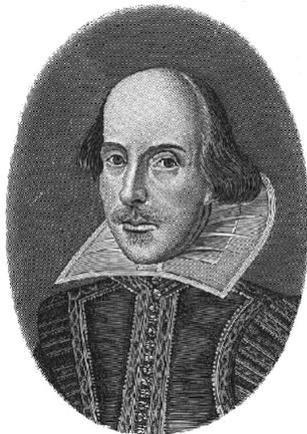
- ❑ give yourself time to think
- ❑ manage your time carefully: consciously choose how you spend your time
- ❑ learn to multiplex



Only "how to" book recommended by Bill Clinton

I've given away 50+

## Learn how to write *really* well #5



- ❑ can *not* overstress importance of good writing
  - ❖ the most important course?
- ❑ "unfair advantage" in paper, proposal review
- ❑ outstanding investment of your time
- ❑ study role models

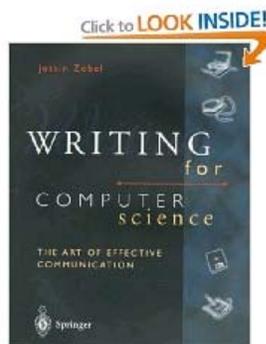
"No tale is so good that it can't be spoiled in the telling"  
Proverb

<http://www-net.cs.umass.edu/kurose/writing/>

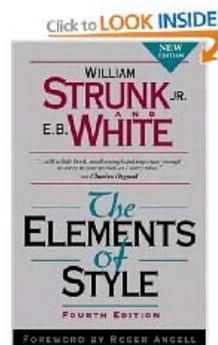
## Top-10 tips for writing a paper

1. Every paper tells a story
2. Write top down
3. Introduction: crucial, formulaic
4. Master basics of organized writing
5. Put yourself in place of reader
6. Write precisely (be specific, don't embellish)
7. No one (not even your mother) is as interested in this topic as you
8. State results carefully
9. Study the art of writing
10. Good writing takes time

## Recommended reading:



**Writing for Computer Science**  
by Justin Zobel



**The Elements of Style**  
by William Strunk E. B. White  
(50 years old – and still a classic!)

## Learn how to speak *really* well #6



- ❑ can't overstress importance of good speaking
  - ❖ important course to teach/take?
- ❑ "unfair advantage" in mindshare
- ❑ convey exciting story/message
  - ❖ thoughtful
  - ❖ engaging
  - ❖ clear, concise
- ❑ practice, practice, practice
  - ❖ videotape, critique yourself
  - ❖ study role models

## Learn the *process* of doing research #7



apprenticeship

- ❑ our field is a guild
  - ❖ grad student = apprentice
  - ❖ professor = master artisan
- ❑ it's about more than the results in your thesis
  - ❖ you'll be generating results for a lifetime
  - ❖ knowing process is what's most important
- ❑ why your advisor can't (and shouldn't) solve (or even define) the problem for you

#8

## Think about what you want to do afterwards

### academia:

- ❑ teaching schools
- ❑ research-1 schools
- ❑ big v small; public v private
- ❑ country?
- ❑ do you love (or at least like) to teach? students?

### industry:

- ❑ many different types of industry settings
  - ❖ startup
  - ❖ “big industry”
  - ❖ research labs
- ❑ research institutes



#9

## A community of scholars



- ❑ meet people, listen, collaborate
  - ❖ good students, colleagues, friends
- ❑ approach, talk with people
- ❑ interactions with peer students
  - ❖ research discussions
  - ❖ paper presentations
  - ❖ practice talks
  - ❖ ....

## Identify role models

#10



- ❑ who does something you care about *really* well?
  - ❖ how do they do it?
- ❑ many role models:
  - ❖ no one does everything
  - ❖ find your balance
- ❑ get a mentor
- ❑ be a mentor

## The last word

#11



Have fun – enjoy  
what you are doing

**Best piece of advice I  
ever received (1984):**

*“Pick a place, job where you’ll  
have fun, enjoy living, enjoy  
your colleagues. Without that,  
no level of success will make  
you happy.” Jack K. Wolf*

## What have others added (1)?

- ❑ learn how to deal with rejection
  - ❖ it'll happen now and then, for the rest of your professional life (hopefully not with your partner)
  - ❖ learn from rejection: *Why* was paper/proposal rejected? *What* did/didn't reviewers see/like?
- ❑ know your “secret weapon”
  - ❖ what “unfair advantage” do you have over everyone else?
- ❑ learn how to change topics
  - ❖ boring to do same thing for 30 years!

## What have others added (2)?

- ❑ learn how to deal with stress
  - ❖ life balance, life changes, too much work
- ❑ learn how to multiplex
  - ❖ you'll be doing it the rest of your life
- ❑ learn how to read/review/write fast, but well
  - ❖ and follow the 90/10 rule

## Questions!

- ❑ What did I miss?
- ❑ What advice would you give to 1<sup>st</sup> year student?