Informatics 1

Functional Programming Lecture 19

Monday 28 November 2011

You and Your Research

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Computing in the News

Today the likes of Google, Microsoft and other leading technology names will lend their support to the case made to the government earlier this year in a report called Next Gen.

In 2003 around 16,500 students applied to UCAS for places on computer science courses. By 2007 that had fallen to just 10,600, and although it's recovered a little to 13,600 last year, that's at a time in major growth in overall applications.

The problem, according to those campaigning for change, begins at school with ICT—a subject seen by its detractors as teaching clerical skills rather than any real understanding of computing.

"Coding is the new Latin," says Alex Hope, co-author of that Next Gen report which kicked things off.

— BBC News, Monday 28 November 2011

Final Exam:
2.30–4.30 Monday 12 December 2011
Computing Labs, Appleton Tower, 5th floor

- Show how you test your code!
  Use examples in the problem.
  Use QuickCheck.
- The allocation of students to exams and rooms will be determined in advance.
- Special needs students will be contacted separately.

This week.

Tuesday: Competition results.

Wednesday: No extra tutorial. (Strike day.)

Thursday and Friday: Tutorials as normal.

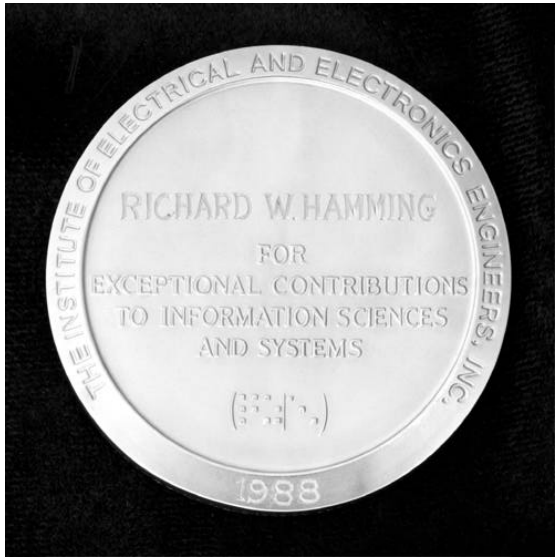
Mock exam results returned in tutorial.

Part I

You and Your Research

Richard W. Hamming, 1915–1998

- Los Alamos, 1945.
- Bell Labs, 1946–1976.
- Naval Postgraduate School, 1976–1998.
- Turing Award, 1968. (Third time given.)
- IEEE Hamming Medal, 1987.



It's not just luck

"Say to yourself, 'Yes, I would like to do first-class work.' Our society frowns on people who set out to do really good work. You're not supposed to; luck is supposed to descend on you and you do great things by chance. Well, that's a kind of dumb thing to say."

— Hamming

"Luck favors the prepared mind" — Pasteur

"If others would think as hard as I did, they would get similar results"

— Newton

Brains and Courage

"How about having lots of 'brains?' It sounds good. Most of you in this room probably have more than enough brains to do first-class work. But great work is something else than mere brains."

— Hamming

"One of the characteristics of successful scientists is having courage. Once you get your courage up and believe that you can do important problems, then you can. If you think you can't, almost surely you are not going to."

— Hamming

Turn a problem into an asset

> "Early on it became evident to me that Bell Laboratories was not going to give me the conventional acre of programming people to program computing machines in absolute binary. . . . I finally said to myself, 'Hamming, you think the machines can do practically everything. Why can't you make them write programs?' What appeared at first to me as a defect forced me into automatic programming very early. What appears to be a fault, often, by a change of viewpoint, turns out to be one of the greatest assets you can have."
>
> — Hamming

Knowledge accumulates like compound interest

"One day I discovered that John Tukey was slightly younger than I was. John was a genius and I clearly was not. Well, I went storming into Bode's office and said, 'How can anybody my age know as much as John Tukey does?' He leaned back in his chair, put his hands behind his head, grinned slightly, and said, 'You would be surprised Hamming, how much you would know if you worked as hard as he did that many years.' I simply slunk out of the office!

"What Bode was saying was this: 'Knowledge and productivity are like compound interest.' Given two people of approximately the same ability and one person who works ten percent more than the other, the latter will more than twice outproduce the former [sic]. The more you know, the more you learn — it is very much like compound interest. I dont want to give you a rate, but it is a very high rate."

— Hamming

What are the important problems?

Hamming started to eat at the Chemistry table. “I started asking, ‘What are the important problems of your field?’ And after a week or so, ‘What important problems are you working on?’ And after some more time I came in one day and said, ‘If what you are doing is not important, why are you working on it?’ I wasn’t welcomed after that.

“In the fall, Dave McCall stopped me in the hall and said, ‘Hamming, that remark of yours got underneath my skin. I thought about it all summer. I haven’t changed my research, but I think it was well worthwhile.’ I noticed a couple of months later he was made the head of the department. I noticed the other day he was a Member of the National Academy of Engineering. I have never again heard the names of any of the other fellows.”

— Hamming

Develop reusable solutions

"How do I obey Newton's rule? He said, 'If I have seen further than others, it is because I've stood on the shoulders of giants.' These days we stand on each other's feet!

"Now if you are much of a mathematician you know that the effort to generalize often means that the solution is simple.

"I suggest that by altering the problem, by looking at the thing differently, you can make a great deal of difference in your final productivity because you can either do it in such a fashion that people can indeed build on what you've done, or you can do it in such a fashion that the next person has to essentially duplicate again what you've done."

— Hamming

Sell your work

"I have now come down to a topic which is very distasteful; it is not sufficient to do a job, you have to sell it. 'Selling' to a scientist is an awkward thing to do. It's very ugly; you shouldn't have to do it. The world is supposed to be waiting, and when you do something great, they should rush out and welcome it. But the fact is everyone is busy with their own work. You must present it so well that they will set aside what they are doing, look at what you've done, read it, and come back and say, 'Yes, that was good.' If they don't stop and read it, you won't get credit."

— Hamming

Part II

Other advice

Time Management

- Getting Things Done, David Allen.
- Fixed-schedule productivity, Study-Hacks blog, Cal Newport. (Also see version on 'I want to be rich' blog).

Communication skills

- *The Elements of Style*, Strunk and White.
- *Politics and the English Language*, Orwell.
- *The Visual Display of Quantitative Information*, Tufte.
- *Envisioning Information*, Tufte.
- *Visual Explanations*, Tufte.
- *Beautiful Evidence*, Tufte.
- Any well-written fiction.

Computing and Society

Identity cards. What is the right way to balance accountability with privacy?

Communication and mobility. What happens when mobile phones merge with computers merge with the internet merge with GPS?

Trust and reliability. How can you safely download new software to your phone? Or your car?

Resources:

- Computer Professionals for Social Responsiblity (CPSR), www.cpsr.org.
- Risks to the Public in Computers and Related Systems, Peter G. Neumann, catless.ncl.ac.uk/Risks.

Computational Thinking

"In their capacity as a tool, computers will be but a ripple on the surface of our culture. In their capacity as intellectual challenge, they are without precedent in the cultural history of mankind."

— Edsger Dijkstra

"Computer Science is no more about computers than astronomy is about telescopes."

— Edsger Dijkstra

See papers by Alan Bundy and Robert Constable, linked from my blog.

You don’t need luck, but you are lucky!

The computer age is barely half a century old.

Computers have yet to find their Galileo, Newton, or Kepler.

It could be you!