A Survival Guide for Fluctuating CS Enrollments

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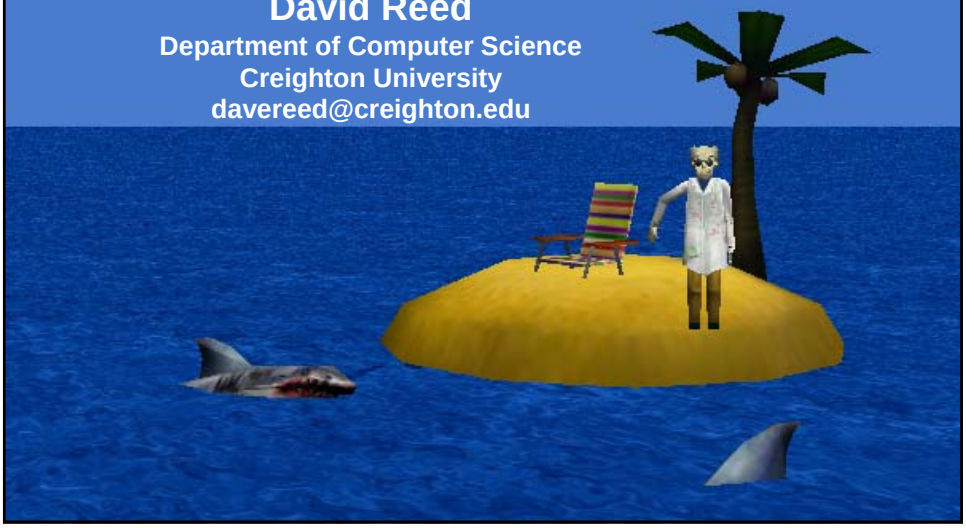


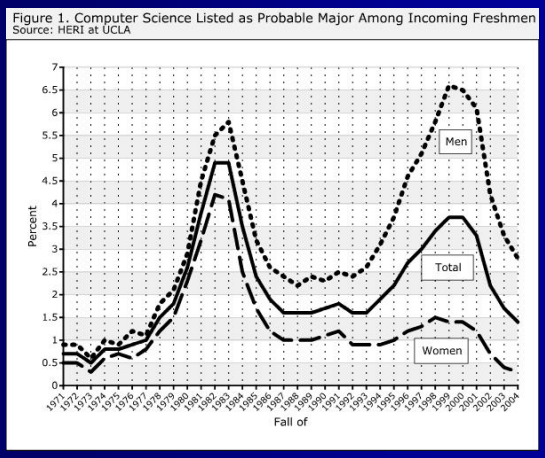
Overview

- the enrollment landscape
- contributing factors
- possible responses
  - the Storm Weatherer
  - the Salesman
  - the Integrator
  - the Tinkerer
  - the Renovator
- making CS relevant & coherent
- making CS interesting & fun

A Disturbing Trend

Higher Education Research Inst. has surveyed freshman across the country

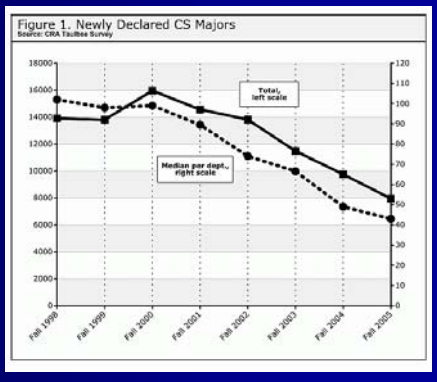
- interest in CS has declined more than 60% from 2000 to 2004
- interest by women has fallen to levels unseen since the 1970's



Result: Declining Enrollments

Taulbee survey of Ph.D.-granting CS/CE programs has shown corresponding decreases in majors

- number of new CS majors has declined by more than 50% since 2000



the decline is evident at high schools as well

- the number of students taking AP CS exams has decreased the last two years (despite big increases for other subjects)

Contributing Factors

- bad economy (or perception of economy)
  - CS enrollments seem closely tied to career outlooks
  - the tech industry has followed a dramatic 6-8 yr hiring cycle

    early/mid 80's → late 80's/early 90's → mid/late 90's → early/mid 00's
  - the latest bust was severe due to a confluence of events
    - dotCom crash, outsourcing, 9/11, ...

why is CS so tightly linked with jobs?

- many see CS as a professional field, not science or liberal art
- partially our own fault – we constantly tout the high demand and high pay for graduates

Contributing Factors

- we're not the only game in town anymore

  before: a student interested in computers had to learn from us
  a student interested in an IT career had to major in CS

  now: computers/applications/references are available & easy
  computing is integrated into many subjects

- the way we are teaching CS may not be compelling and/or relevant to students
  - many students are already tech savvy
    manage facebook site, install RAM, download/rip music & video, ...
  - these students are not overly impressed with CS1/CS2

  do CS curricula reflect the new computing landscape?

Good News on the Horizon?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SPECIAL REPORT:
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Study says U.S. tech hiring grows

Trade group reports that domestic increase in technology jobs offsets the work being sent overseas.

February 23, 2006: 8:19 AM EST

NEW YORK (CNNMoney.com) - Demand for technology workers in the United States continues to grow in spite of American companies shifting more technology work overseas, according to a new study.

The Association for Computing Machinery, a professional development organization that includes academic, government and industry officials from the information technology field, released a study Thursday that said that shifting IT jobs to countries like India or China is not nearly the threat to workers here that is commonly believed.

National Association of Colleges and Employers (NACE) Job Outlook 2005:

- CS among the top 10 degrees in demand
- CS had the 5th highest starting salary at $50K (top among non-engineering)

Bureau of Labor & Stats predicts new IT jobs will increase 30% by 2014

- 13% overall → 1/19 new jobs will be IT

programmer	+ 2%
support specialist	+ 23%
systems analyst	+ 31%
database admin	+ 38%
network admin	+ 38%
software engineer	+ 46%

Beyond the Horizon?

anecdotal data suggests that colleges may be turning the corner

- at Creighton, more freshman interest in the CS major than in the past 6+ years

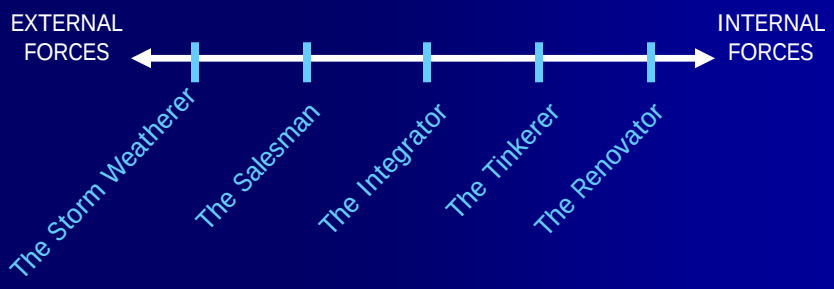
even if enrollments improve, the CS landscape has definitely changed

- computing careers are less about programming and more about problem-solving, teamwork, and communication
- computer science is more integrated with other fields, especially the natural and social sciences

will we be talking about this again in 6-8 years?

The Fault Spectrum

approaches to low enrollments vary depending upon where the fault/responsibility is perceived to be



The Storm Weatherer

if low enrollments are the fault of industry and out of our control, then we just need to "ride it out "

seems naïve, but it is a commonly held view (at least to some extent)

ships vs. boats

- weathering the storm is easier at large universities
  - adjunct pool can contract, grad students can mask numbers, ...
- at smaller colleges, the risks are increased
  - a small program may sink before the storm runs its course!

No Responsibility at All?

The Salesman

slightly less naïve: CS curricula are basically fine, we just aren't selling CS well enough

- potential students may not understand what CS is really about
- colleagues/administrators may also be unaware

1st rule of selling: know your product!

- can we articulate what it is that makes CS a coherent and important field of study?

Selling CS

first, develop a coherent picture of CS that you want to portray to potential students

then,

- go to the source
  - talk with local high schools, especially AP programs
  - visit freshman seminars & new student orientations
- be active and visible on campus
  - seminars, contests, fund raisers, gamefests, ...
  - print glitzy fliers, t-shirts, frisbees, ...
  - talk with colleagues, get on committees, ...
- publicize successes
  - advertise career successes by graduates
  - push faculty accomplishments & curriculum innovations

The Integrator

interesting trend: branching out and integrating CS with other fields

- e.g., biology, physics, graphic design
- might be as simple as faculty meetings to explore interdisciplinary applications
- organizing joint seminars or independent study groups with other departments
- developing cross-listed courses or interdisciplinary minors

An Integrated CS

advantages of integration with other subjects

- more accurately reflects the new CS landscape
- cross-listed courses may have better enrollments due to the combined student pool
- interdisciplinary programs forge allies
  - it's good to have other departments invested in us

at Creighton

- consulted with science faculty about interdisciplinary apps
- developed *Interactive Web Dev.* minor w/ Graphic Design
- developed core course, honors courses, Sr. perspective
  - good PR & recruitment, also pads enrollment numbers

The Tinkerer

if advertising & integration aren't enough, then we need to adjust/update what we do

- not necessarily wholesale changes to the CS curriculum, but selective revisions or new course offerings

tinker to achieve specific goals

- make CS more attractive and more relevant to students
- possibly recruit new majors
- at the very least, reach more students and improve enrollments

Common Tinkering

- CS0 overview course
- updated intro sequence, perhaps using tools (e.g., BlueJ, Karel, Alice) or themes (e.g., events, multimedia)
- special topics courses (e.g., bioinformatics)

at Creighton

- CSO course with Web & science themes
- CS1/2 in Java using BlueJ w/ experimentation & communication themes
- new topics courses, incl. HCI (with no prereq)

The Renovator

some are taking this opportunity to renovate their curricula

- involves lots of work
- risky, but a potentially big payoff

- might simply involve updating curriculum to emphasize modern trends (e.g., peer-programming, experimentation, communication)
- introducing new tracks or specialized degrees
  - bioinformatics (NJIT, RIT, UCSD, BC)
  - computational science (SUNY-Brockport, Ill State, Macalester)
  - gaming/multimedia (GaTech, DePaul, UDenver, WPI)

Renovations at Creighton

at Creighton, we have taken a limited but global approach to renovating the curriculum

- identified 2 unifying themes:
  - empirical problem solving
  - communication skills (both written & oral)
- currently revising all courses to emphasize these themes

advantages

- curricular themes yield a more cohesive view of CS
- these particular themes are especially important in the new CS career landscape
- revisions can be implemented incrementally – doesn't require simultaneous changes across the curriculum

Advice: Make it Coherent & Relevant

empirical reasoning and communication go together well

- it's better to focus on questions, then introduce computing tools/methods to solve those problems
- experimental problem-solving involves clearly stating hypotheses and justifying conclusions

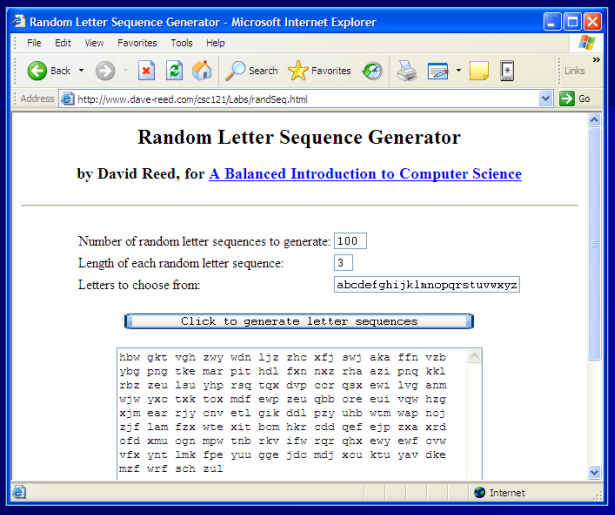
How many 3-letter words are there in the English language?

Why did USA volleyball change from sideout to rally scoring?

Is there a fast & general way to solve a Sudoku puzzle?

see empirical.cs.creighton.edu for a repository of empirical labs

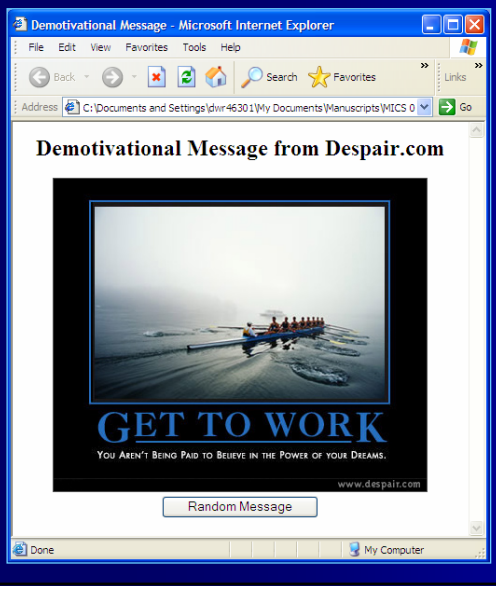
- part of an NSF-sponsored project with Craig Miller & Grant Braught



EXAMPLE: as part of a CS0 assignment, students:

- use a Web page to generate random sequences
- collect data and produce an estimate
- analyze and justify their result in writing

Advice: Make it Interesting & Fun!



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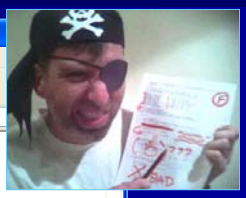

Conclusions

CS enrollments are clearly tied to career outlook

- partially due to our image as a professional field and our emphasis on jobs/$$$

WE CAN (AND SHOULD) TRY TO MINIMIZE THIS EFFECT

the way we react to fluctuating enrollments depends on how much responsibility we assume

- most instructors/schools will fall in more than one category

Storm Weatherer ⇔ Salesman ⇔ Integrator ⇔ Tinkerer ⇔ Renovator

advice: make CS coherent & relevant, interesting & fun

- emphasize a few central themes throughout the curriculum
- integrate real-world problems that are engaging to students