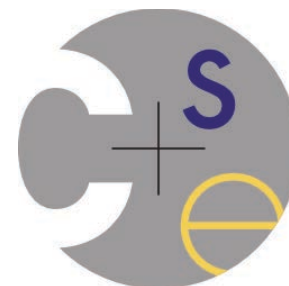


Tsunami or Sea Change?

Responding to the Explosion of Student Interest in Computer Science

Ed Lazowska

**Bill & Melinda Gates Chair in
Computer Science & Engineering
University of Washington**



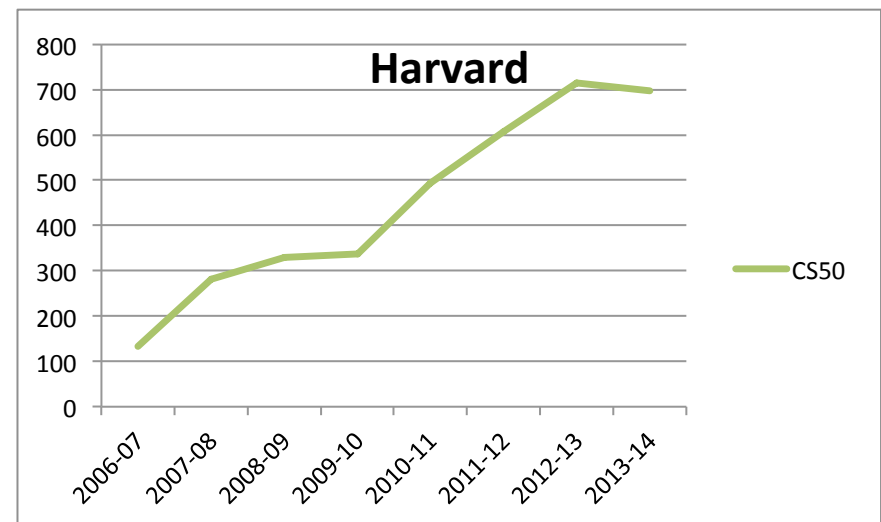
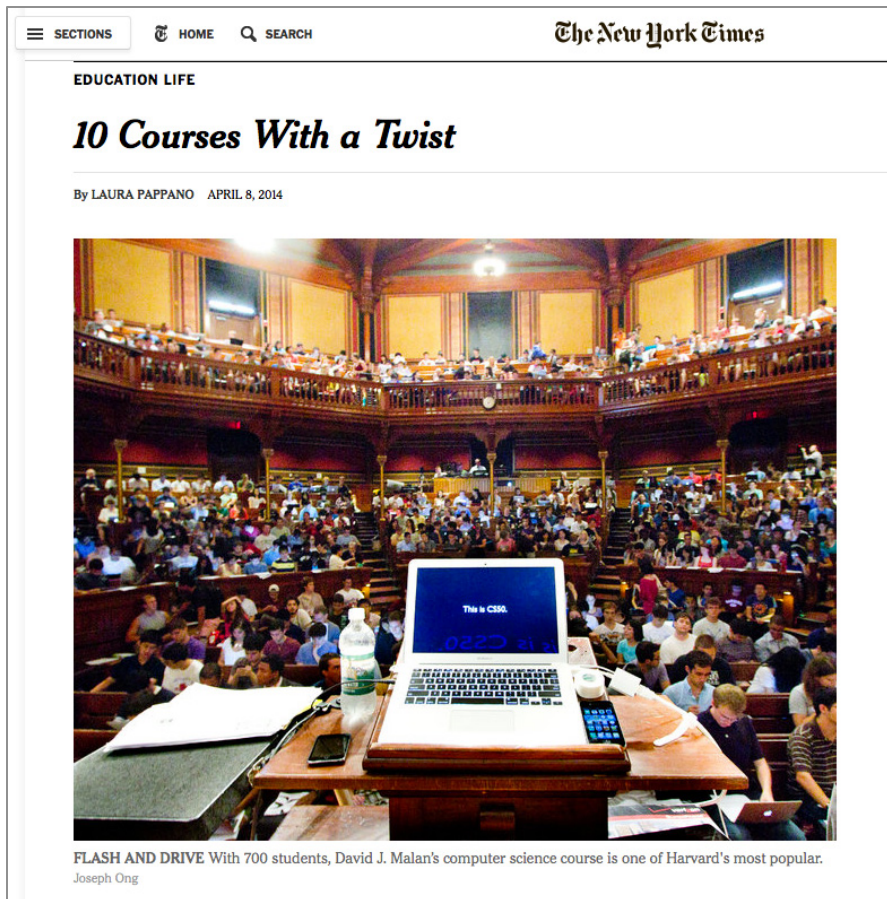
Eric Roberts

**Professor of Computer Science and
Bass University Fellow in Undergraduate Education
Stanford University**

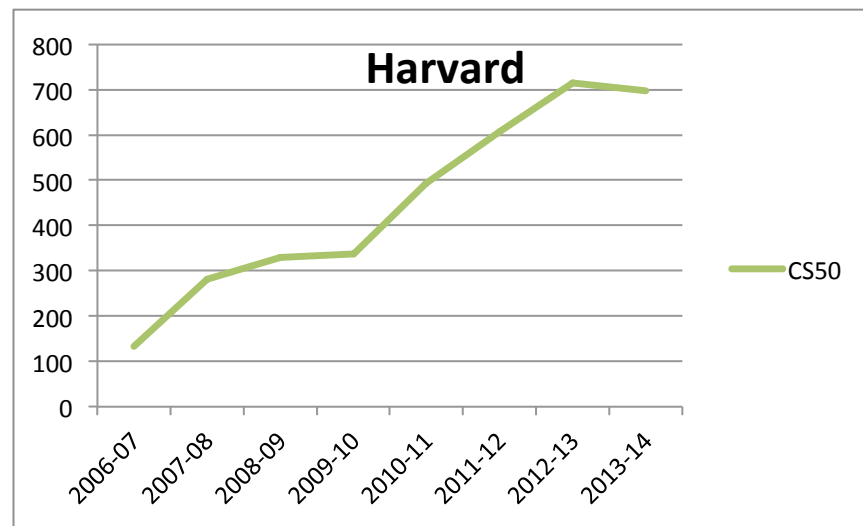
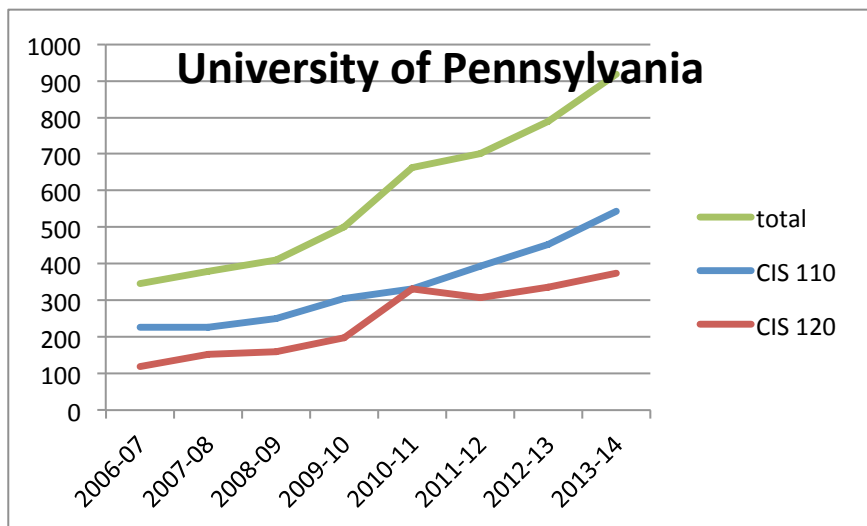
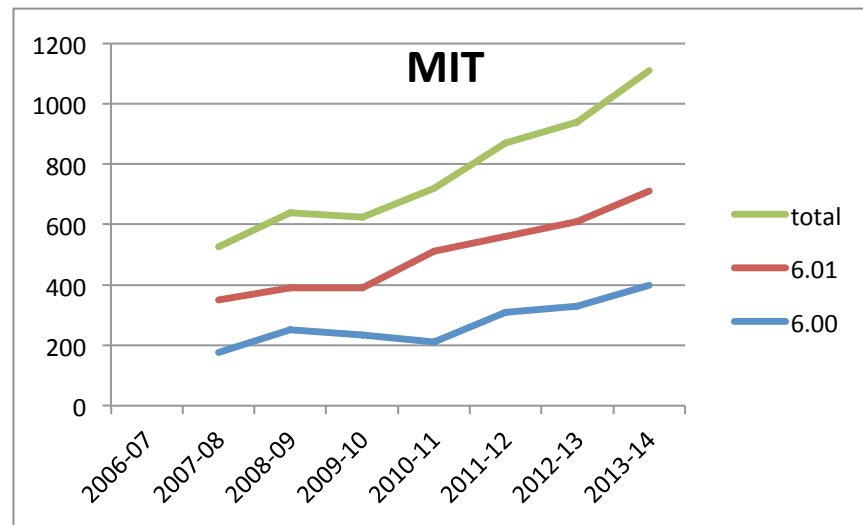
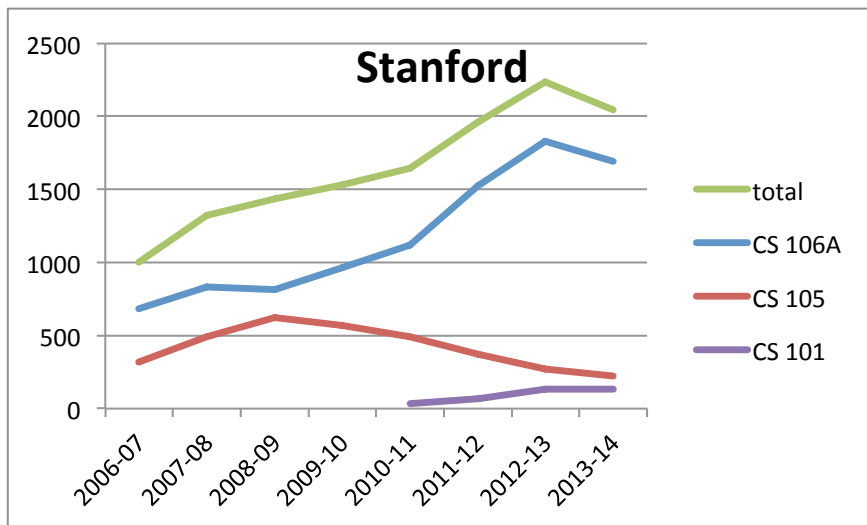


NCWIT 10th Anniversary Summit
May 2014

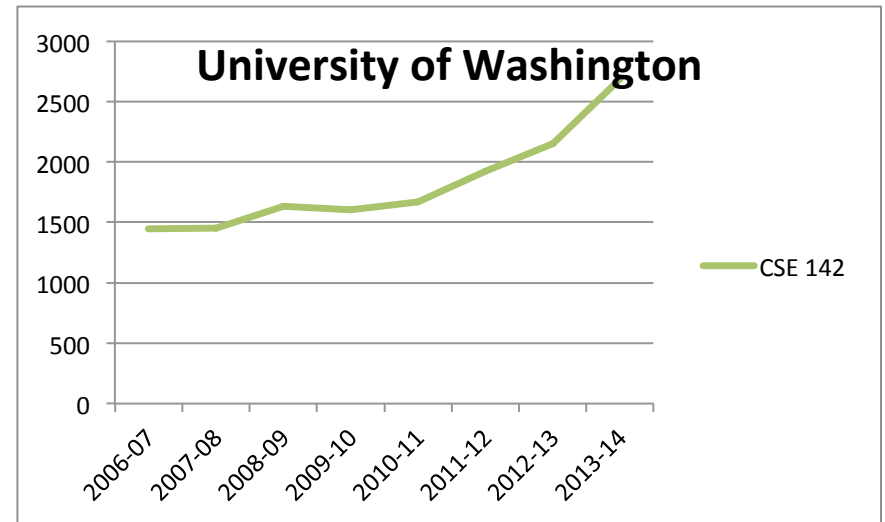
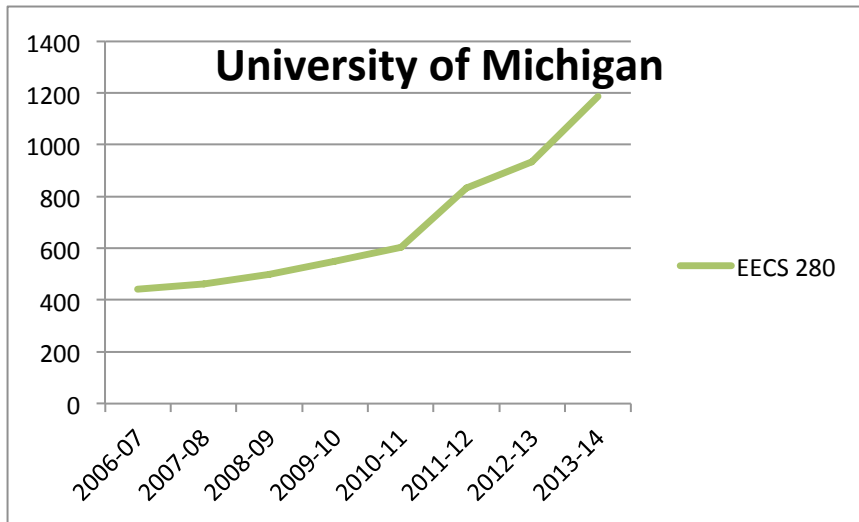
Introductory course enrollments are exploding



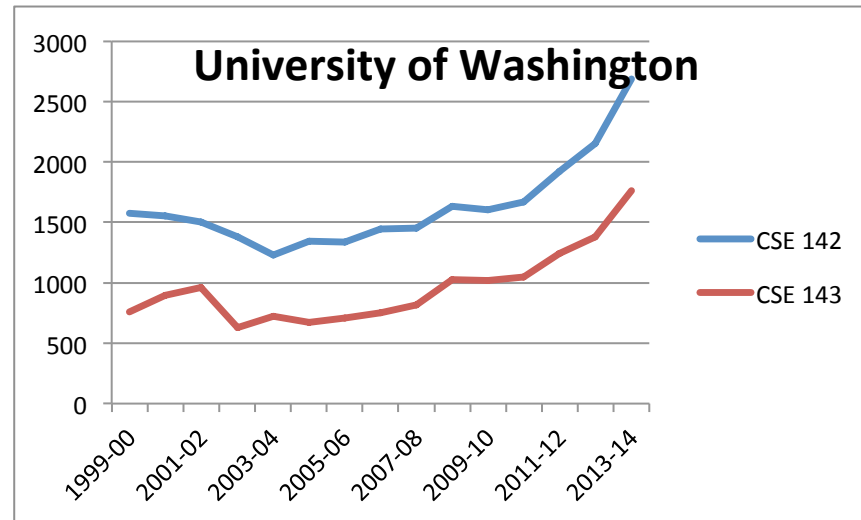
Not just at Harvard



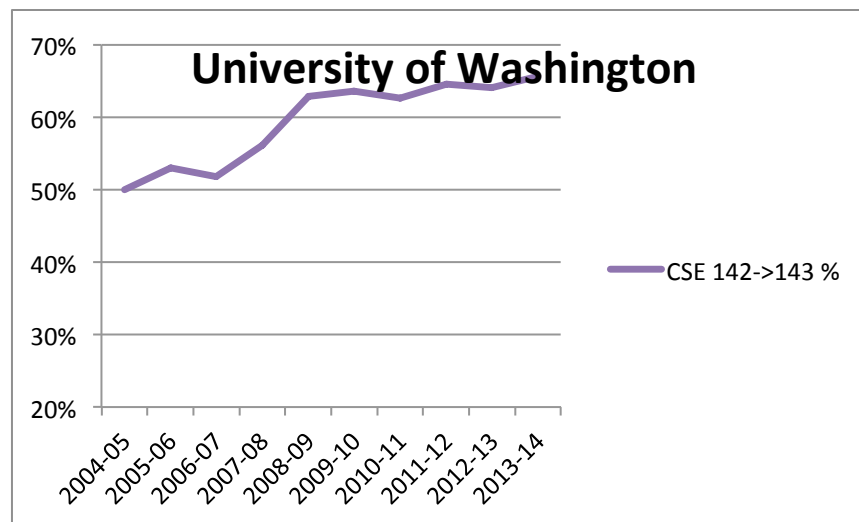
Not just at elite private institutions



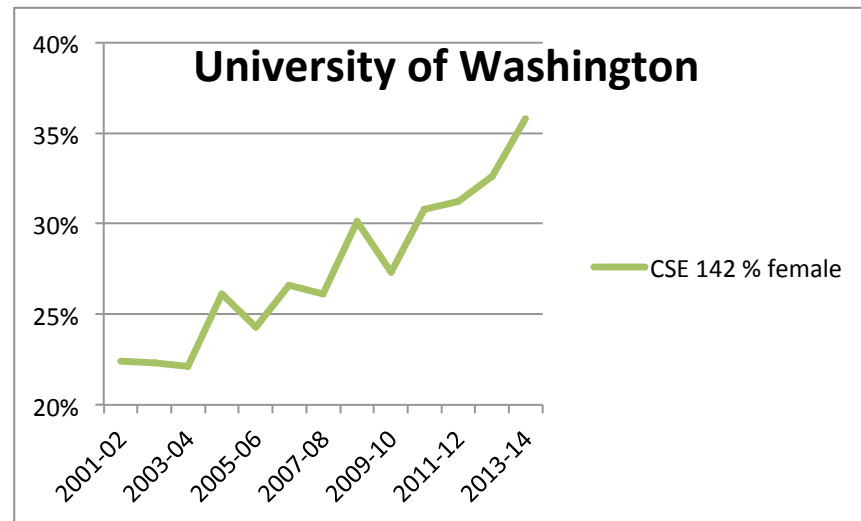
These enrollments are blowing past previous highs



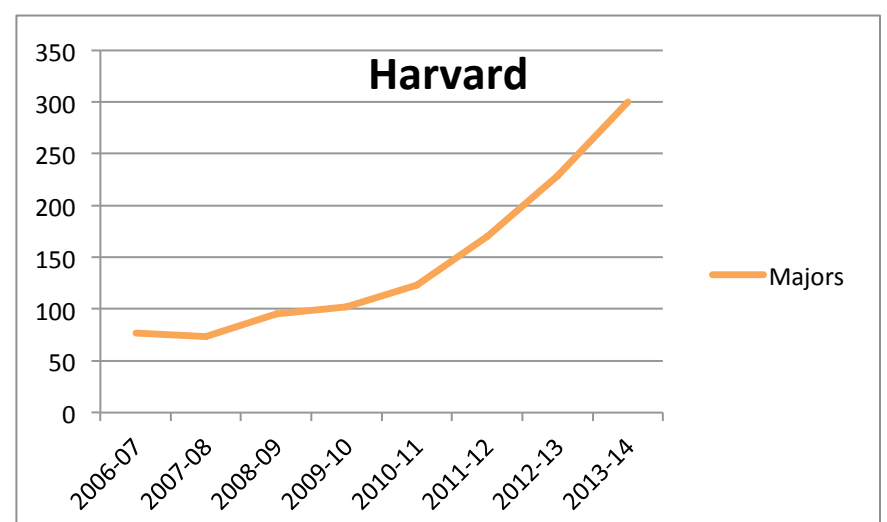
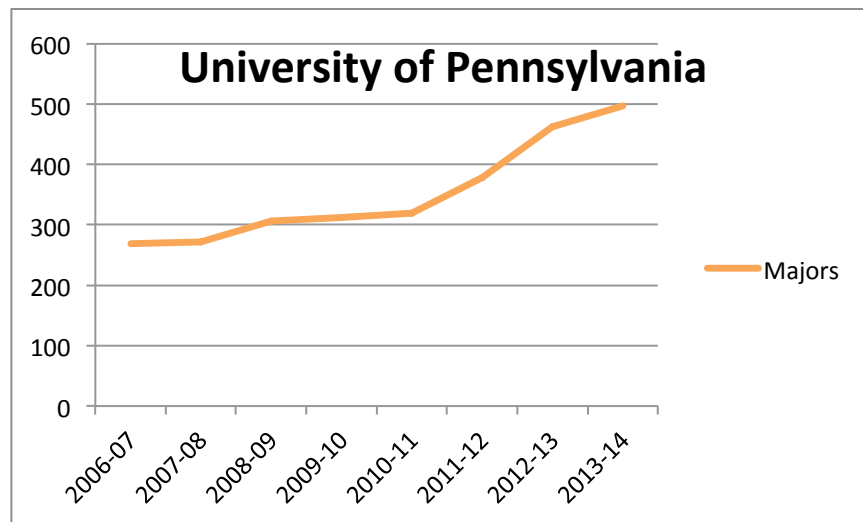
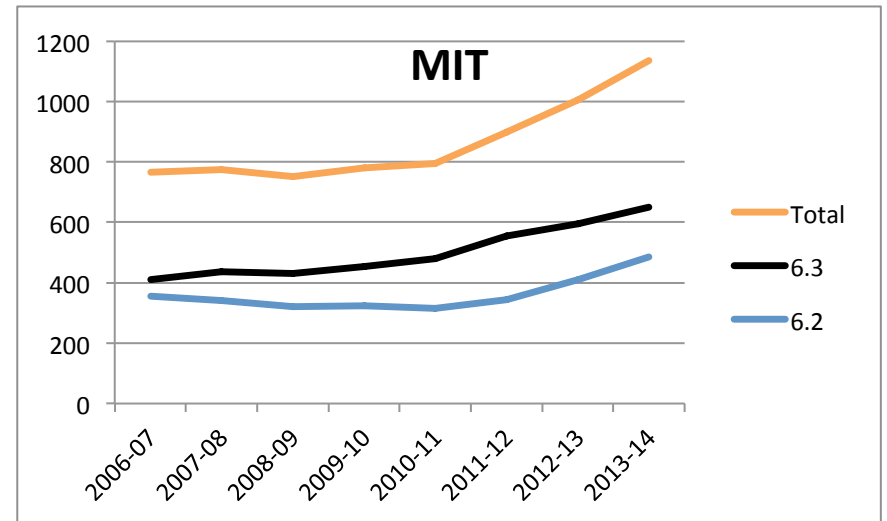
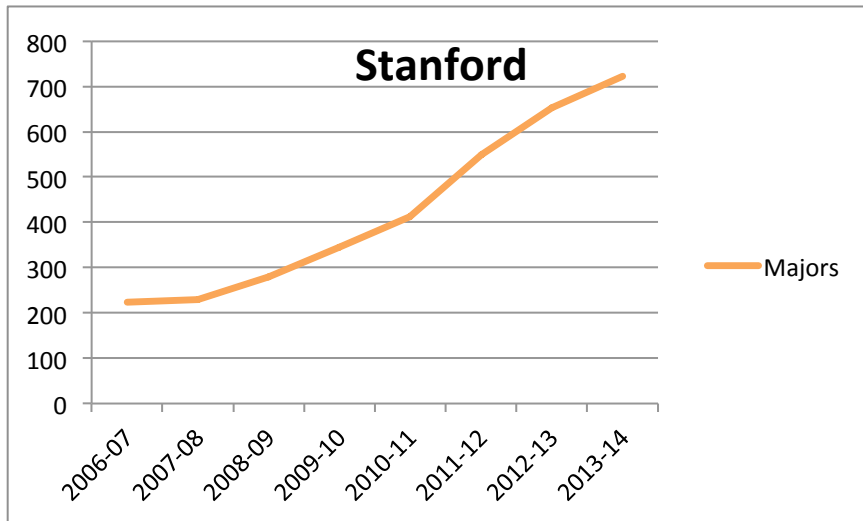
Increasing proportions of students are taking second courses

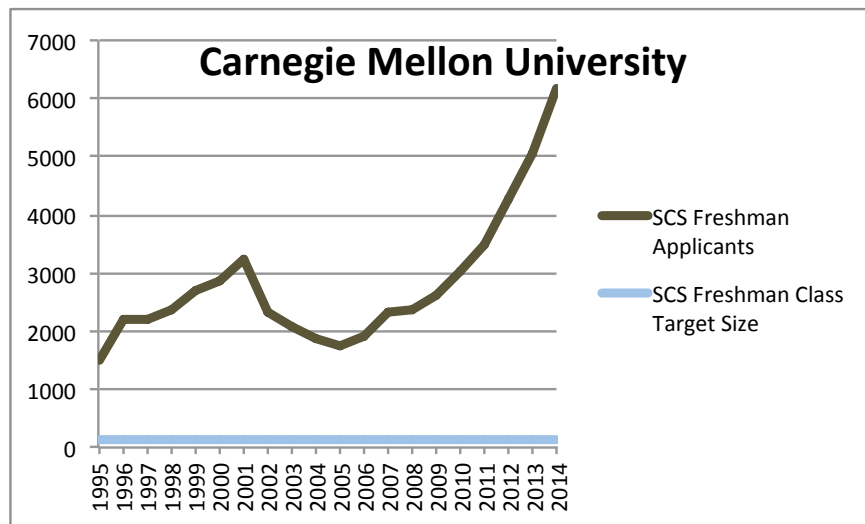


In at least some cases, female participation is increasing



Demand for the major is increasing





Dot-com peak: 3,237

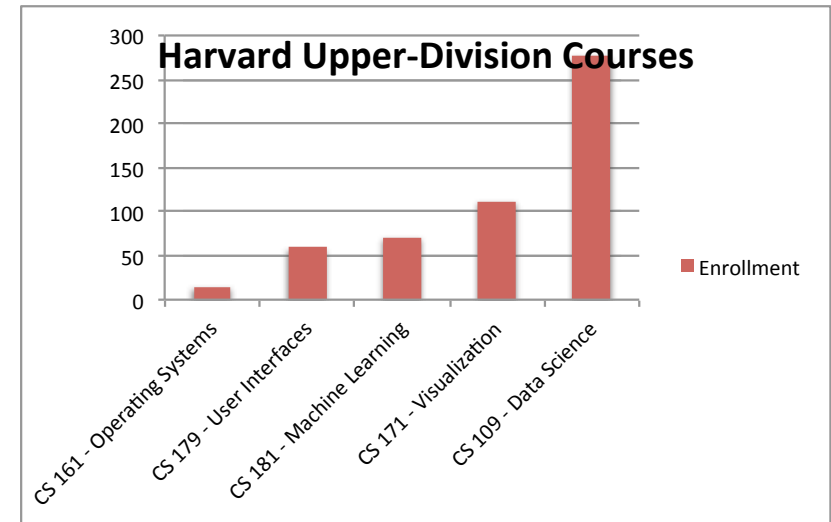
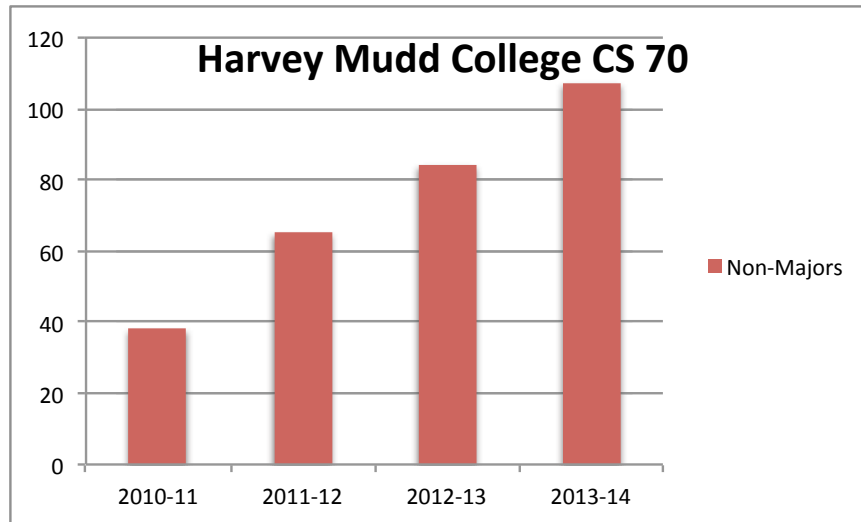
Dot-bust trough: 1,732

Most recent year: 6,174

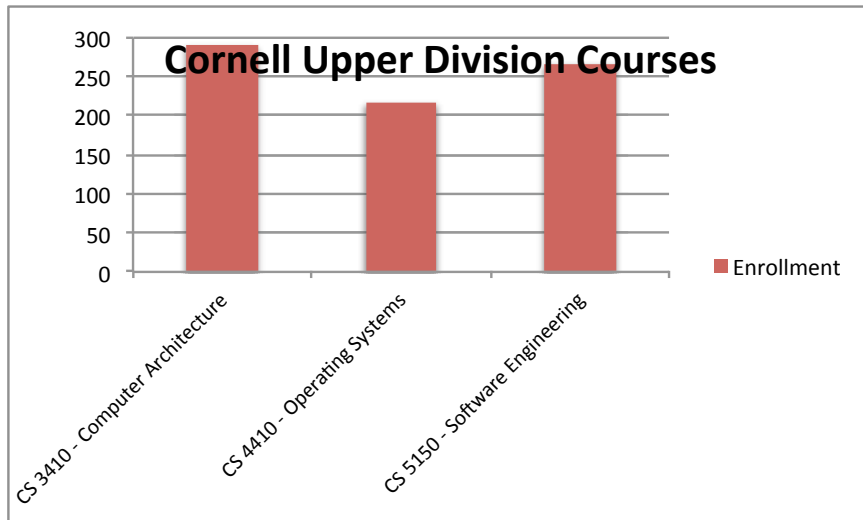
Target enrollment: 135

(+ ~40 upper-division transfers)

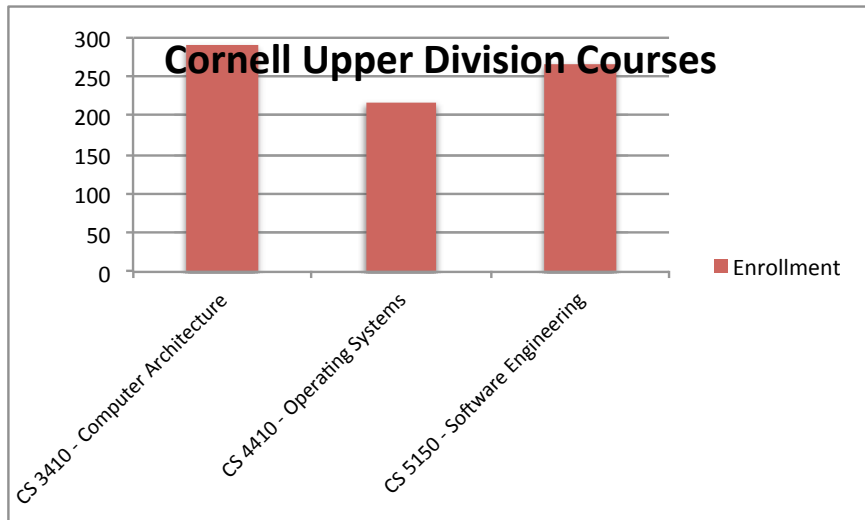
Non-major demand for upper-division courses is increasing, also



Class sizes are going through the roof



Class sizes are going through the roof



CS229
Machine Learning
Autumn 2013

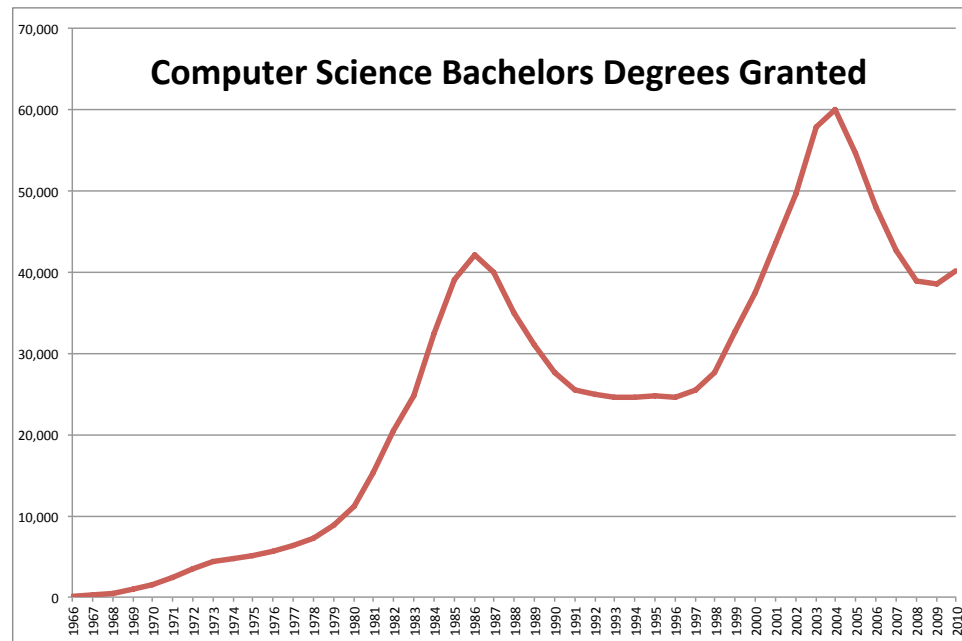
760 students!



Why is this man smiling?



We're all familiar with cycles in demand

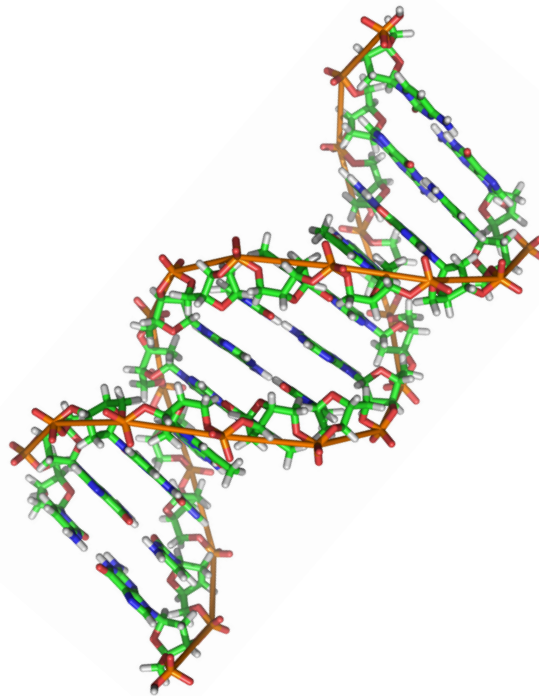


But this time, something feels different

- Possibly, students are figuring out that every 21st century citizen needs to have facility with “computational thinking” – problem analysis and decomposition (stepwise refinement), abstraction, algorithmic thinking, algorithmic expression, stepwise fault isolation (debugging), modeling
 - Programming is the hands-on, inquiry-based way that we teach computational thinking and the principles of computer science



- Possibly, students are figuring out that fields from Anthropology to Zoology are becoming *information* fields, and that those who can bend the power of the computer to their will – computational thinking, but also computer science in greater depth – will be positioned for greater success than those who can't

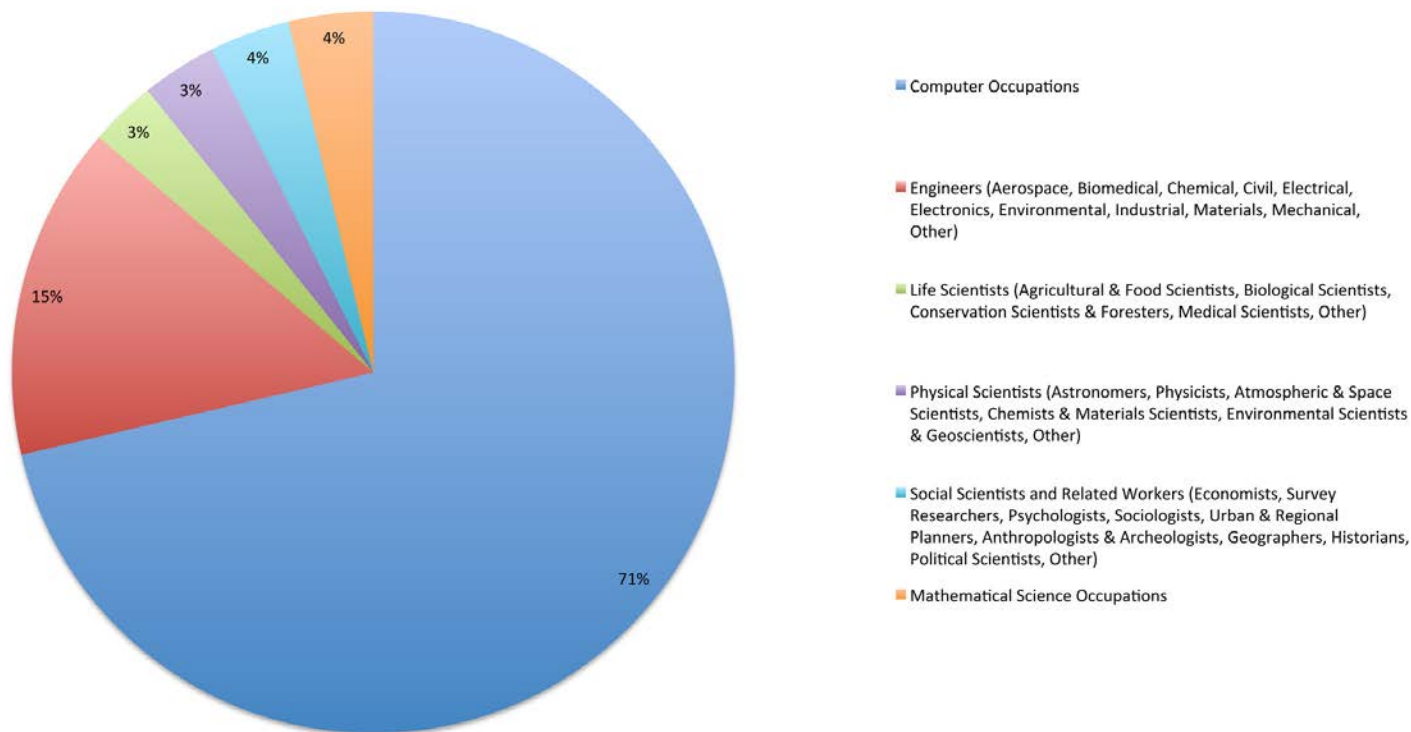


- Possibly, students are figuring out that computer science is not Dilbert – it's an intellectually exciting, highly creative and interactive, “power to change the world” field

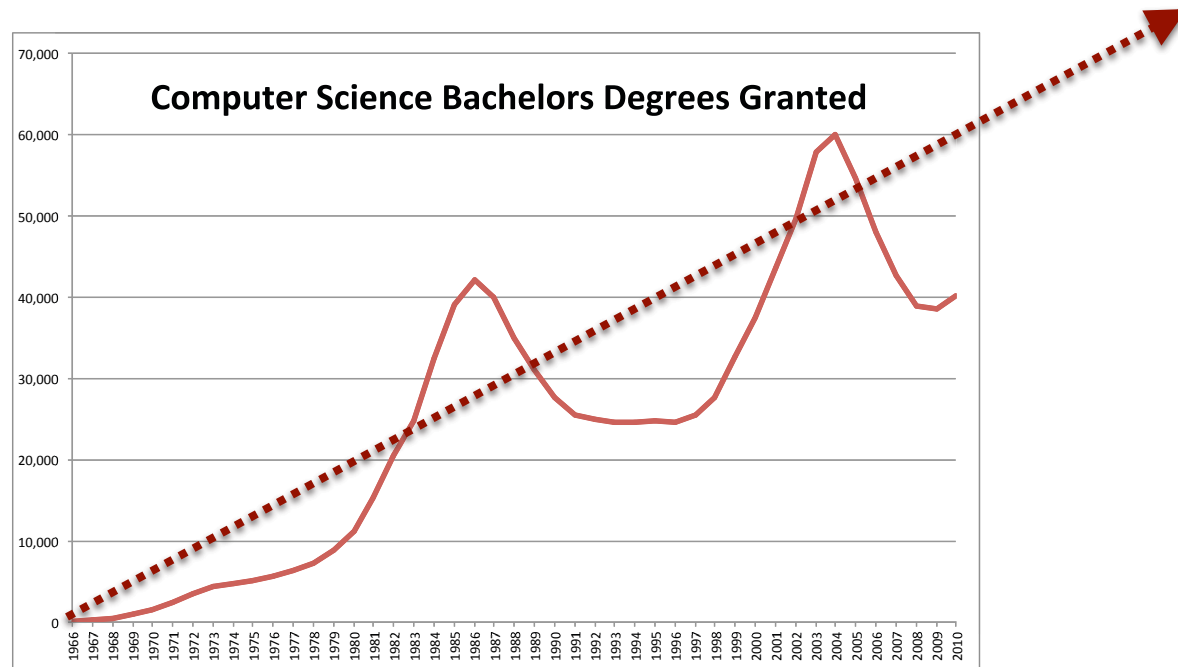


- Possibly, students are figuring out that all of the STEM jobs are in computer science

Job Growth, 2012-22 - U.S. Bureau of Labor Statistics
Computer Occupations = 71% of all STEM



Possibly, the recent dramatic growth will continue



How are we, and our institutions, going to respond?

- 10% of Princeton's students are computer science majors
 - Far more at MIT
- 10% of Princeton's faculty are unlikely to ever be in computer science!
 - Ditto, proportionately, at MIT
- And then there is
 - Introductory course demand ++
 - Upper-division non-major demand ++
 - Graduate non-major demand ++

Some possibilities ...

- Restrict the size of the major
 - Implications for diversity?
- Exclude non-majors from upper-division courses
- Retreat to “the core” – turn over many of our courses to other departments
- Have enormous class sizes and/or enormous teaching loads
- Utilize vast numbers of lecturers
- Have a beer while the students use Coursera

That's what we'll discuss

- What are you experiencing?
- How are you responding today?
- What do you envision in the short-term and long-term future?
- What are the possible implications of various directions for the participation of currently under-represented groups?

Our field is at a critical juncture!



Thanks for providing data!

- Colorado School of Mines: Tracy Camp
- Harvard Univ.: Greg Morrisett, Margo Seltzer
- Harvey Mudd College: Ran Libeskind-Hadas
- Johns Hopkins Univ.: Greg Hager
- MIT: Saman Amarasinghe, Anantha Chandrakasan, Eric Grimson, Laura Moses, Victoria Palay, Daniela Rus, Jacob White
- Rochester Institute of Technology: Andrew Sears
- Stanford Univ.: Eric Roberts, Claire Stager
- Univ. Michigan: H.V. Jagadish
- Univ. Pennsylvania: Sue Davidson
- Univ. Rochester: Henry Kautz
- Univ. Texas: Tiffany Grady, J Moore
- Univ. Utah: Ross Whitaker
- Univ. Washington: Raven Alexander, Crystal Eney, Ed Lazowska, Jen Pesicka
- Wellesley College: Takis Metaxas