

Pathways to Computing: Growing & Diversifying the Workforce

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The Demand, the Challenge & the Opportunity

(The Chronicle of Higher Ed, April 15, 2020)

- **The Demand**

- Since 2007, the number of CS majors has more than quadrupled and departments face huge additional demand for courses by non majors

- **The Challenges**

- intense competition for faculty from industry
- enrollment caps disproportionately impact low-income, URM, and female students
- increasing tilt toward tech curricula creates frictions with other disciplines

- **The Opportunity**

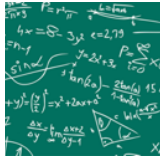
- The need to accommodate the demand has driven curricular innovation and new cross-disciplinary collaborations, enriching all fields

I Computer Science

New Pathways (Onramps) to Computing

- **CS + X Degrees**
 - Blended degrees, not double majors; mostly undergraduate degrees
 - institutions experimenting: UIUC, Stanford, Northwestern, U Mass Amherst
- **Bootcamps & Other training programs**
 - A spectrum of programs, with widely varying costs & success rates
- **Bridging programs**
 - More formal academic programs designed to prepare students with undergraduate degrees for graduate studies in computing
 - Northeastern's Align program, UIUC's iCAN program, Columbia, Gatech, and more coming (actually, returning... ala Berkeley's re-entry program back in the 1980s)

CS + X @ Illinois: Motivations & Philosophy



- Today, **computing is ubiquitous and essential for everyone**. According to the National Science Foundation: “[K]nowledge of computer science and computer programming is becoming a necessary skill... in marketing, advertising, journalism, and the creative arts.”



- **Groundbreaking blended degrees:** CS + X students learn core concepts from both CS and X, and, upon graduation, are prepared for careers, including graduate study, in both CS and the X discipline.

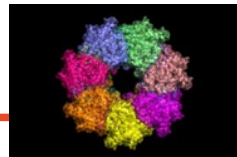


- 13 degrees (11 since 2014) spanning 4 colleges
- Advertising, Animal Sciences, Anthropology, Astronomy, Chemistry, Crop Sciences, Chemistry, GIS, Linguistics, Math, Music, Philosophy, Statistics



- **Intellectual diversity:** CS + X students ready to lead in new directions

- e.g., in Ag Tech (new Center for Digital Agriculture, co-led by the College of ACES and Grainger Engineering)



Computer Science Bachelor's Degree Programs

College of LAS
(Liberal Arts & Sciences)

Mathematics & CS
Statistics & CS

CS + X

Anthropology

Astronomy

Chemistry

Linguistics

Geography & Geographic Info Science

Philosophy

Economics

GRAINGER
ENGINEERING

CS

College of
FAA

CS + Music

College of ACES
(Agricultural, Consumer
and Environmental
Sciences)

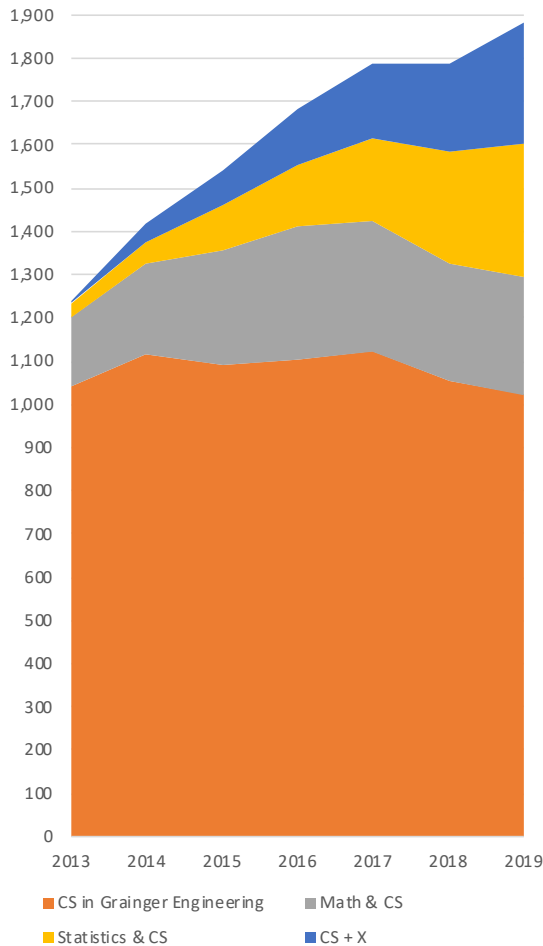
CS + Crop Sciences
CS + Animal Sciences

College of
MEDIA

CS + Advertising

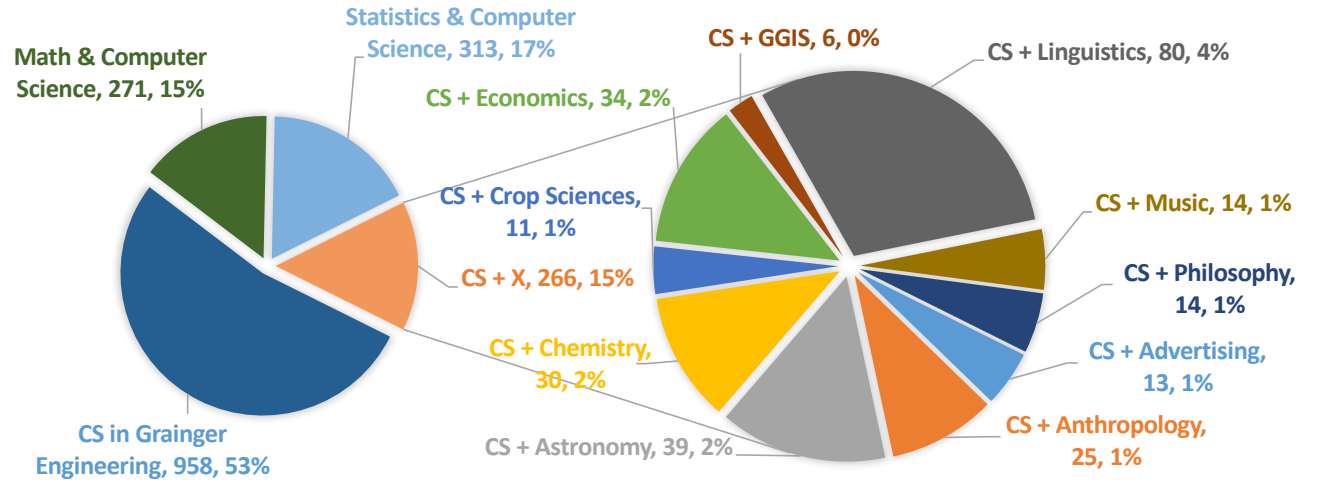
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**CS UNDERGRADUATE ENROLLMENTS (DMI)
Fall 2013 - Fall 2019**



CS + X @ Illinois: By the Numbers

CS UNDERGRADUATE ENROLLMENTS, SPRING 2020 (DMI)



Blended Majors (CS + X, Math & CS, Stats & CS): are now 47% of all CS majors

SPRING 2020 CS UNDERGRADUATE DEMOGRAPHICS (DMI)

	Male	Female	URM
CS + X	72.9%	27.1%	6.4%
Math & CS, Stats & CS	77.4%	21.6%	3.6%
CS in Grainger Engineering	69.5%	30.5%	9.3%



Note: CS + Animal Sciences launches in Fall 2020.

Illinois CS: Innovating in Education & Diversity



[Tiffani L. Williams](#)
Teaching Professor & Director
of Onramp Programs

Motivation

- We are not serving many students who could enrich computing -- in thought, experience, ethnicity, and gender
- Strong interest from students who have a bachelors (or higher) degree in other fields, but hesitate to try our MCS due to lack of confidence to learn basics on their own

The iCAN Program (Illinois Computing Accelerator for Non-Specialists)

- A small (4-5) set of bridging courses providing CS fundamentals (coding, data structures, algorithms, systems)
- Leads to a certificate and a performance-based path to our MCS, MS & PhD
- Capstone internship embeds students with industry, government or research
- Need-based scholarships available during iCAN; then students eligible to TA
 - Facebook has committed \$300K
- ~~Program launch in Fall 2020, first in Urban and then in Chicago and online~~
- Program launch in Fall 2020, first online and then in Chicago and in Urbana

Opportunities for CISE & SBE Collaboration

- Computer Scientists not equipped to study some important issues, but could with partners in SBE
 - Why do some CS+X programs fail (e.g., Stanford) and some thrive (e.g., Illinois)?
 - Why is the gender balance in some CS+X majors worse than in X or CS? And why is it better in others?
 - How can we increase the participation and success of underrepresented groups in CS+X and other pathway programs?
 - How can we provide the community and support needed for non-traditional and at risk students in online and remote settings necessitated by COVID-19?