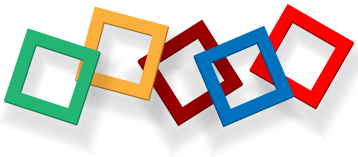
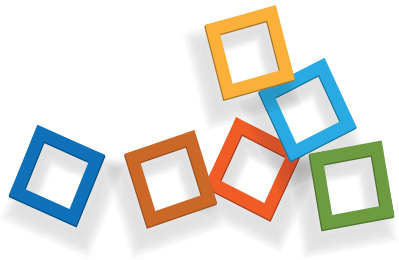


Generation CS:

Computer Science Undergraduate Enrollments Surge Since 2006



A. CRA Enrollment Committee: Institutional Impact

Across North America, universities and colleges are facing a significant increase in enrollment in both undergraduate computer science (CS) courses and programs. The current enrollment surge has exceeded previous CS booms, and there is a general sense that the current growth in enrollment is substantially different than that of the mid-1980s and late 1990s. For example, since the late 1990s, the U.S. Bureau of Labor data shows that the number of jobs where computing skills are needed is on an upward slope, illustrating the increased reliance our society has on computing. We also know how pervasive data has become in the science and engineering fields, which means all scientists and engineers need more computational skills than ever before. It is, therefore, not surprising that the number of nonmajors taking computer science classes is increasing, and that 78% of computer science units[1] stated the number of minors in their unit is increasing.

In early 2015, the Computing Research Association (CRA) created a committee to investigate several questions related to increasing enrollments. The CRA Enrollment Committee set up two committees: an Institution Subgroup and a Student Subgroup. The goal of the Institution Subgroup was to answer high-level questions such as "How are units handling the current growth in computer science?" The goal of the student subgroup was to answer high-level questions such as "Why are students so interested in computing?" This report addresses questions from the Institution Subgroup, questions that concern computer science units, such as:

1. Are all units seeing a similar degree of growth?
2. Does the growth exist at all levels of the curriculum?
3. Are non-majors and minors having a significant impact on enrollment?
4. How is the current growth impacting diversity in our student population?
5. What are units doing to respond to the growth?

To answer these types of questions, the CRA Enrollment Committee's Institution Subgroup created a CRA Enrollment Survey. The CRA Enrollment Survey was administered in parallel with CRA's annual Taulbee Survey of doctoral-granting units and ACM's annual NDC Study of non-doctoral granting units in computing. Responses were sought only from units that have a computer science undergraduate degree program. The goal was to measure, assess, and better understand enrollment trends and their impact on computer science units, diversity, and more.

We are grateful to the 134 doctoral-granting units and 93 non-doctoral granting units that responded to the CRA Enrollment Survey, which produced a response rate of ~70% (for doctoral institutions via Taulbee) and ~13% (for non-doctoral institutions via NDC). The data collected from the CRA Enrollment Survey is extremely rich, and allows us to consider a unit's context (e.g., size, public or private, etc.) and resources available when considering the impact from enrollment growth.

One section of the CRA Enrollment Survey asked responders to provide detailed demographic data on students enrolled in four representative CS courses: an intro-level course that is mainly for non-majors, an intro-level course that is mainly for

[1] We use the term "academic unit" or "unit" to denote the administrative division responsible for the CS bachelor's program. Often, but not always, this is an academic department.

CS majors, a mid-level course, and an upper-level course. Data was requested on these four representative courses across three different time periods (2005, 2010, and 2015). While annual data on degrees awarded and enrollment in majors is available from other sources, we are unaware of any other data regarding student demographics in specific courses over the period of the aforementioned decade (2005-2015). The CRA Taulbee survey has added questions to its survey in order to continue collecting this type of data.

The enrollment growth in the mid-1980s is sometimes referred to as the "PC boom" and the enrollment growth in the late 1990s is sometimes referred to as the "dot-com boom." CRA Snowbird Conference attendees suggest that we are currently in "Generation CS," where CS enrollment across the nation is surging due to the pervasiveness of computing in today's society. Computing plays a significant role in daily life, and students with interests in a variety of fields are beginning to understand that training in computer science is vital.

This report consists of six sections and three appendices in which we present and analyze the data collected from the CRA Enrollment Survey. Section B considers the phenomenal growth of computer science majors in North America since 2006 (e.g., the number of CS majors enrolled at North American doctoral[2]-granting units has more than tripled since 2006); furthermore, the data indicates that this continued growth is likely. Section C considers the phenomenal growth of nonmajors taking computer science courses and discusses the data that units reported on the increase in computer science minors.

We discuss diversity in Section D. Many members of the computer science community are very concerned about the impact of the current student enrollment surge on diversity, as we learned several hard lessons regarding diversity in previous enrollment booms. While more data is needed, there appears to be some good news regarding both the numbers and percentages of women and underrepresented minority students involved in computer science as majors and as students in CS courses; unfortunately this good news does not exist for all units that responded to the survey.

In Sections E and F, we consider the impact of the current enrollment surge on the unit (e.g., challenges with space and instructional staff), as well as how units are responding to the current surge (e.g., increasing section sizes or number of sections taught). Lastly, this report includes three noteworthy appendices. Section G considers degree completions in computer science from the Integrated Postsecondary Education Data System (IPEDS) data. This section helps advance our understanding of the data collected in the CRA Enrollment Survey, and provides more information about the current surge in computer science at non-doctoral granting units (where data from the CRA survey is limited). Section H discusses the survey's methodology, and Section I provides access to all figures individually as well as the data that comprises the figures in this report. Finally, Section J acknowledges everyone who has assisted with the survey, data, analysis, or report.

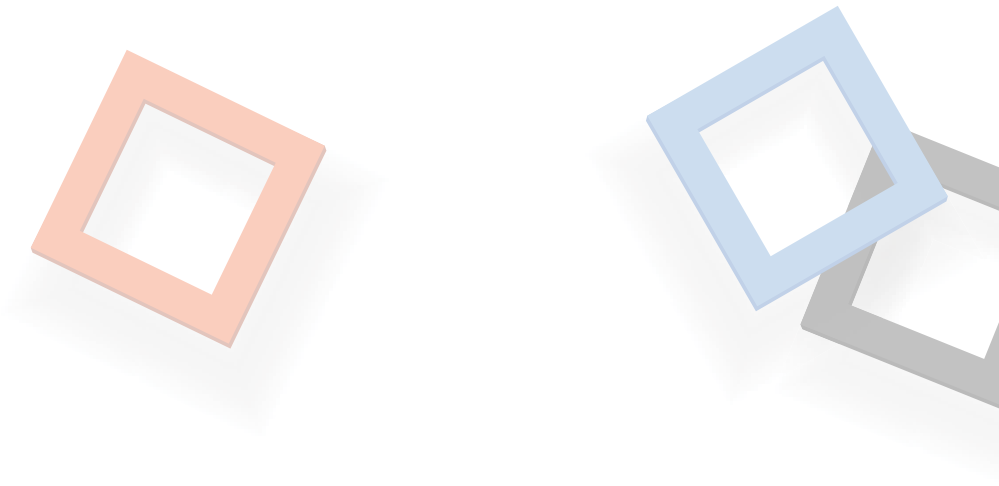
Please contact any member of the CRA Enrollment Committee's Institution Subgroup with questions about the report. The committee members are:

- Tracy Camp, Chair, Colorado School of Mines (tcamp@mines.edu)
- W. Richards Adrion, University of Massachusetts Amherst (adrion@cs.umass.edu)
- Betsy Bizot, Computing Research Association (bizot@cra.org)
- Susan Davidson, University of Pennsylvania (susan@seas.upenn.edu)
- Mary Hall, University of Utah (mhall@cs.utah.edu)
- Susanne Hambrusch, Purdue University (seh@purdue.edu)

[2] Our report mainly focuses on doctoral-granting units, as more data is available on doctoral-granting units than non-doctoral granting units. We strongly encourage non-doctoral granting units to complete the annual ACM NDC!

- Ellen Walker, Hiram College (walkerel@hiram.edu)
- Stuart Zweben, The Ohio State University (zweben.1@osu.edu)

We also encourage those interested in more details and analysis about the current enrollment surge in computer science to obtain an upcoming report from the National Academies of Sciences, Engineering, and Medicine's ad hoc Committee on Growth of Computer Science Undergraduate Enrollments. The report is expected to be published later this year.



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CRA Enrollment Committee (Institutional Subgroup)

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