UNIVERSITY OF CALIFORNIA, SANTA CRUZ

BERKELEY · DAVIS · IRVINE · LOS ANGELES · MERCED · RIVERSIDE · SAN DIEGO · SAN FRANCISCO

SANTA BARBARA · SANTA CRUZ

COMPUTER SCIENCE DEPARTMENT
BASKIN ENGINEERING BUILDING
SANTA CRUZ, CALIFORNIA 95064

+1 (831) 459-2158
FAX +1 (831) 459-4829

Jan. 28, 2017

Committee Members
Committee on Educational Policy
University of California
Santa Cruz, CA 95064

Dear Members,

The undersigned professors in the Computer Science Department are gravely concerned about recent proposed changes in the Computer Science program that have been sent to CEP to appear in the 2017–18 catalog. These changes water down our program so that it becomes significantly weaker than our peers and allows our students to graduate lacking significant amounts of material *required* by the Curriculum Guidelines of ACM, the main professional society for Computer Scientists. We urge CEP not to approve these changes and, in particular, not to allow them to enter the catalog, causing catalog rights to be granted for about five years for a massively watered down Bachelor of Science in Computer Science.

Watering down the B.S. in Computer Science from UCSC will do grave harm to the students who earn the degree with the proposed requirements, both in getting accepted to graduate school and getting good jobs in high tech industries. At the same time, this change is unnecessary because the department already offers a Bachelor of Arts for students that want a less rigorous pathway to a degree in Computer Science.

There is a serious lack of data to support the proposed changes. One of us asked the Undergraduate Director, Prof. Suresh Lodha, to compare our major requirements with some other UC campuses. He did not do so, so we made a brief check of B.S. requirements for Computer Science at Berkeley, Davis and Irvine. (Please see the table appended to this letter.) Of course Berkeley is a flagship campus, while we consider Davis and Irvine to be our peers. Our summary comparison is attached. Unless stated otherwise, all comparisons are for a B.S. in Computer Science. Our summary indicates that UCSC requirements are already on the light side in terms of quantity, compared to these three campuses. Very briefly, UCB requires 29, UCD 27, UCI 28, while UCSC requires 22.

We understand that Berkeley and Irvine have many more faculty than UCSC in Computer Science, and Davis is also larger. They can offer a larger variety of classes where students choose from a small group to get the coverage of an important topic. At UCSC we tend to have one required class in which that important topic is covered.

The most disastrous change is eliminating the course *Computational Models* (CMPS130) from the list of required courses. This course introduces the structure of the basic grammars and languages used for humans to communicate with computers. Another serious watering-down is eliminating the course *Introduction to Compilers* (CMPS104A) from the list of required courses. This course studies the techniques used to convert computer languages, including regular expressions and context-free grammars, into computer-readable form, *i.e.*, machine instructions. Students greatly improve their computer programming skills in this course, along with learning how the computer actually processes the instructions they give it when they write a program.

These two core courses on computer languages and how computers use them have now been made elective, leaving the total course count in Computer Science unchanged, but allowing students to bypass many topics central to computer science.

A recent external review recommended that we consider how our curriculum fits the ACM Curricular Guidelines and make adjusts where indicated. This document exceeds 500 pages, divides recommended allocations into two tiers considered "required", and relegates many other topics to "elective." It makes allocations to "knowledge areas" in lecture hours. Somehow only three "knowledge areas" are deemed to be worth an entire course, and allocations are very fractured. The explanation put forward to CEP for the above changes makes vague references to this document, which we dispute. We believe that the members of that external committee would be flabbergasted that the department is considering the above changes at all, and even more so that they are justifying them by ACM guidelines.

In particular, the subject matter of *Computational Models* covers several core topics in the ACM Curriculum in "knowledge areas" of Discrete Structures, Algorithms, and Programming Languages. None of the proposed changes replaces those topics. Likewise, eight hours of core topics in programming languages are covered in *Introduction to Compilers* and nowhere else in the *required* curriculum.

If our B.S. graduates in Computer Science are interviewing for a job in a Silicon Valley company, they are very likely to be asked questions probing their knowledge of both different implementation options for object-oriented languages (CMPS 104A) and regular expressions (CMPS 130). Companies and graduate schools *expect* that Computer Science B.S. graduates understand this material. If, instead, it emerges that most UCSC grads don't understand it, then our students become poor candidates for open positions. Because appearing once in the catalog confers catalog rights for about five years after it is taken out, it would take a decade to repair the damage to our department's reputation.

The argument that making CMPS 130 and CMPS 104A electives frees students to choose other courses that are currently electives is thin, first because the program already includes four electives, and second because none of the courses mentioned as alternatives ranks very highly in the ACM scheme. For example, Machine Learning is allocated two tier-2 lectures hours, Natural Language Processing, Distributed Systems, and Database Systems get no tier-1 or tier-2 hours, and Data Visualization rates part of one tier-1 hour. (CMPS 165 deserves a higher rating than the name implies because of its tie-in to Social Issues, which are deemed to be relatively important. One needs to know the syllabus to realize this, illustrating that cursory analysis is insufficient for evaluating the connection of a course to the ACM Curriculum.)

Another department proposal is to drop the requirement for two courses in either physics or chemistry. With this change the lower-division portion of the B.S. differs from the B.A. by only one course, a math course. In a brief check of Computer Science B.S. requirements at some other UC campuses, we found that Davis and Berkeley both require at least three courses in physics and/or chemistry (see the summary comparison attached). Irvine also encourages "hard science", but allows alternatives in fields such as geology and anthropology. We believe that to deserve the name "university" an undergraduate education should include some breadth, and calling a graduate a Bachelor of *Science* should imply some scientific breadth beyond one major field. It appears that UC campuses generally hold a similar view.

The justification to CEP for dropping all physical science requirements is that 22 courses "is viewed as very heavy requirements." But our comparison UC campuses have B.S. requirements in Computer Science with totals as follows:

UCB: 29, UCD: 27, UCI: 28.

Since the change is in the lower-division requirement, UCSC currently stands at 10, while the comparison totals are:

UCB: 13, UCD: 14, UCI 15.

We understand that in writing this letter we are arguing against a decision arrived at by a (slim) majority (and with several faculty abstaining) of the Computer Science Department. We are taking this step for two reasons:

- We believe that the department meeting during which the decision was taken was extraordinarily hasty in its procedure. It did not allow for appropriate discussion of the issues nor did it consider all implications of the decision.
- As mentioned, the potential for damage to the reputation of the department is great. We absolutely don't need this.

With these considerations in mind we ask that CEP does not accept the proposed changes, instead giving the Computer Science department the opportunity to revisit the issue through a more appropriately considerate process.

Sincerely,

Allen Van Gelder
Phokion Kolaitis
Dimitris Achlioptas
Darrell Long
Ethan Miller

Comparison to Three Other UC Campuses, prepared for CMPS faculty but never presented in a meeting.

==========

I looked at web pages for Berkeley (berkeley.edu), Davis (ucdavis.edu), and Irvine (uci.edu).
All have a BS, some have a BA too. I assume they are on semester, so their 4-unit classes equate to our 5-unit classes, close enough.
So I will count classes, not units.

Davis: Lower div: 5 ECS, 4 Math, 1 dont-know, 4 Phys or 4 Chem. total 14.
Upper: 6 core (4 req. 2 with some "ors"), 7 electives. total 13
Total in Major: 27.

Berkeley: Lower div: 2 EE, 3 CS, 5 Math, 2 Phys + 1 in any nat. sci. total 13.
Upper: 5 EECS, 7 engr electives. total 12.
Total in Major: 25.

Irvine: Lower div: 9 core, 6 math. total 15.
Upper: 1 writing, 1 alg, 11 other with 6-7 in a specialty. total 13.
Total in Major: 28. 12 GE must include >= 3 in science and tech.
(but a student can skate science and take low-level CS)

UCSC: Lower div: CSE 3, Math 5, 2 Phys or 2 Chem. total 12.
(I call CE16 "Math")
Upper: 8 req, 4 elec, total 12.
Total in Major: 24.
(According to Suresh, Total in Major = 22-24.
One can reasonably argue that we have labs for more units, so the total in major is more like 26 for comparison.)

==========

Davis Total for a BS: 45 of which >= 16 are upper div.

Berkeley Total for a BS: There are gen-ed also but I cant quantify.

Irvine Total for a BS: >= 40 of which >= 13 are upper div.

UCSC Total for a BS: >= 36 of which >= 12 are upper div.

==========