BPC Plan for Computer Science Department, Duke University

Plan effective dates: Sep 1, 2020 - Aug 31, 2023   **Revision will begin:** Jan 1, 2023.
Contact Person: Jun Yang, Chair, Computer Science Department.

Context: The 2019 Computing Research Association Taulbee Survey found that the percentage of women nationwide who graduated with BS, MS, and PhD in Computer Science in 2018-19 was 21.0%, 27.2%, and 20.3%, respectively, and that 23.5% of tenure-track faculty were women. The CS Department at Duke University is committed to improving the participation of women in its student and faculty community, and various steps we have taken -- including revamping courses, introducing team-based experiential learning, and a successful DTech program -- have resulted in significant progress. As a highlight, the percent of women graduating with a CS major has increased from about 20% (the national average) to over 35% in the last five years. The overall rates of participation by women in computer science at Duke are listed below.

Population	Total Number	Women
Duke CS Graduate Enrollment (Ph.D.)	67	20.9%
Duke CS Graduate Enrollment (Masters)	47	42.5%
Undergraduate Duke CS Class Graduated in 2020	340	35.3%

The picture is quite different for groups underrepresented in computing, such as African Americans and Hispanic. For instance, the percent of African Americans among Duke undergraduates is around 9%, while those majoring in CS is around 6.5%. Though the latter number is larger than the national average of 4.1%, there is significant room for improvement. At the graduate level, there is an even greater need to improve participation: At most two out of our 114 graduate students are African American or Hispanic.

Goals: Goal (G1) is to broaden the participation of women in computer science major at the undergraduate level. We believe this is both a plausible and impactful goal. Our overall rates of participation in the major are still lower than equitable: Roughly 52% of Duke undergraduates are women, 45% of students in the first course CompSci 101 are, while about 35% of computer science majors are. Furthermore, broadening the participation at the undergraduate level will also impact the rest of the pipeline – the percentage of women in graduate school, technology industry, and faculty.

Goal (G2) is to improve the pool of students from groups underrepresented in computing, particularly African Americans and Hispanics, at both the undergraduate and graduate level. A significant challenge here, in addition to retention, is increasing the raw number of students from these groups, and this also requires sustained outreach into earlier stages of the pipeline.

Activities. To reach these goals, we take a holistic approach that includes curricular efforts, co-curricular programs, and mentoring. These activities build on the impactful programs we have already implemented.

Participation in Research and Teaching (Goal G1, G2). **[Contact: K. Munagala, X. Yang, N. Washington]**
We will encourage women and groups underrepresented in computing to pursue research, sign up for independent study courses, and possibly write a thesis.
- *(Ongoing)* Building on our successful annual Spring Undergraduate Research and Project Showcase, we will showcase projects from courses and independent studies every semester.
- *(New)* We will run a per-semester Town Hall meeting where we engage with students to both inform them about research opportunities, and learn about barriers to engagement with our program.
- *(New)* Faculty will advertise their research via centralized announcements and Town Hall style meetings, and invite promising first- and second-year undergraduate students to attend their research meetings. The hope is that this will make students feel part of the research environment, and will naturally draw them into research once they are ready.
- *(New)* We will develop a coordinated system to systematically encourage promising women and students from underrepresented groups to participate in the undergraduate TA pool.

Professional Development and Support. (Goals G1, G2) **[Contact: S. Rodger]**
- *(Ongoing)* We will support student research and professional development by encouraging and financially supporting our students to attend major national and international workshops, CRA-W workshops, the Grace Hopper Celebration of Women in Computing, and the TAPIA conference.

- *(New)* We will create a cohort of students from diverse backgrounds when they declare their major, and will stay with them till they graduate. We will organize social activities, and have gatherings where either faculty give talks or we invite external speakers who can serve as role models.

Summer undergraduate experiences. (Goals G1, G2) We will build on the following successful efforts.

- *(Ongoing)* The 10-week summer programs for undergraduates, Data+, Code+, and CS+ serve over 100 students every summer, about half of whom are female. Students join small project teams collaborating with other teams in a communal environment. These programs are part of a concerted effort to engage students in co-curricular projects early in their undergraduate career, and offer vital opportunities to recruit and mentor students during that time. **[Contact: B. Fain]**
- *(Ongoing)* In the Duke Technology Scholars (DTech) Program, groups of scholars live together through the summer, sharing experiences, learning together, and participating in summer programming with industry leaders. Over 100 women participated in DTech this year. Faculty will work with the D-Tech Program Director to recruit students who are interested in research experiences, not only for the summer programs, but also for mentored research. **[Contact: S. Daly]**

Pedagogical Efforts. (Goals G1, G2) We will take various steps to make the CS curriculum more inclusive, improve departmental climate, and improve retention of students from underrepresented groups.

- *(Ongoing)* We have created several entry points into the major via interdisciplinary introductory courses, interdepartmental majors, and new project and elective courses. We will build on this to introduce additional entry-points and pathways through our major. **[Contact: O. Astrachan]**
- *(New)* We will educate faculty, staff, and students about *cultural competence*: Social identity groups, and the challenges impacting them (intersectionality, racism, bias). We will do this via adding modules to existing training programs and the orientation course for graduate students, and via creating a departmental seminar series about culture and bias. **[Contact: N. Washington]**

Outreach. (Goal G2) **[Contact: N. Washington, B. Fain]** We will perform several activities to improve the pipeline of students from underrepresented groups in the undergraduate and graduate pool.

- *(New)* We will work on proposals to secure funding on activities to broaden participation, such as developing a departmental site REU summer program proposal.
- *(New)* We will partner with HBCUs, e.g., North Carolina Central University, as well as engage with Durham public schools (45% African American) via offering short courses and faculty seminars.
- *(New)* We will expand our summer programs to recruit students from HBCU/HSIs, as well as partner with the DREU program, with the goal of attracting these students to our graduate program.
- *(Ongoing)* We will engage with the Duke University Center of Exemplary Mentoring (UCEM), whose Sloan Program provides financial support and specialized mentoring for Ph.D. students from URMs, making it appealing for these applicants to attend Duke over competing programs.

Outcomes and Assessment. To measure the impact of our retention activities, we will measure (via DataBuddies or in-house surveys) the percentage of women and students from underrepresented groups enrolling in and completing the CS major. For our graduating students, we will also track their career trajectories subsequently. In order to measure the effectiveness of the proposed activities, we will design pre- and post-surveys for students in the summer programs, attending conferences, serving as UTAs, and performing independent study, to measure their participation and satisfaction with the programs by race and gender. We will use the survey reply rate and the information gathered from the survey to gauge whether the questions are designed appropriately and whether they have met our goals of understanding issues in retention and recruiting. We will revise the surveys accordingly. An additional outcome is the publications and presentations at high-profile conferences and journals, measured by race and gender.

In order to better understand attrition and retention rates by demographic groups, we will also design a survey to understand why students choose not to major in CS after taking the introductory courses. This will also help us identify factors (e.g., curricular, departmental culture, mentoring) affecting retention.

For the outreach and mentoring programs, we will measure the frequency with which faculty participate in activities such as giving talks and offering short courses both at forums within Duke and outside, as well as engagement with HBCUs and public schools measured by the number of students and classrooms impacted. For the pedagogical efforts towards changing the culture to be more inclusive, we will develop a *Cultural Competence in Computing* (3C) assessment to measure the constructs of cultural awareness, cultural knowledge, cultural skill, cultural encounters, and cultural desire.