Undergraduate Thesis Prospectus

A Course to Prepare Computer Science Students for For Employment Interviews

(technical research project in Computer Science)

The Gender Disparity In Coding

(sociotechnical research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.
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General Research Problem **Word Count: 1693**

How can preparation and exposure to computer science affect aspiring industry software engineers?

Computer science (CS) related industries have seen a rapid increase in recent decades, largely due to businesses beginning to invest in computer systems. Between 2003 and 2013, the IT industry grew by 37% (Csorney, 2013). Further employment in CS occupations is projected to grow 11% from 2019 to 2029, faster than that average of all occupations (Bureau of Labor Statistics, 2020). With this in consideration, it is important to shed light on the flaws of entering this workforce, since these problems may affect a large pool of people. The CS industry is relatively new, with personal computer systems only growing in popularity in the 1980s (Shallit, 1995), making it due time that societies need to consider how to better prepare people to enter computer science.

A Course Design to Prepare Computer Science Students for Industry Interviews

How can the Computer Science Curriculum be tuned to better prepare students for the industry's interview expectations?

This CS capstone project will be completed independently by myself under the supervision of advisors Professor Farzad Hassanzadeh and Jack Davidson. CS undergraduate students should theoretically graduate with enough CS knowledge to be competent software engineers. However, before entering the industry, they have to prove to the employer that they have this readiness with usually, a series of interviews. It is common that companies will send out technical tests to promising applicants, and then conduct multiple technical interviews before they are confident to hire the candidate. "The technical test and phone interview are designed to

determine if you have the necessary technical skills to succeed in the position" (University of Chicago, n.d.). However, many undergraduate students never receive formal training from their university on how to excel in technical interviews. Instead, many of the students will resort to outside sources to receive their training, such as the popular interview preparation book "Cracking the Coding Interview". There is a demand for a course like this in an undergraduate curriculum.

This course design aims to have students finish with a greater preparation for industry interviews, including a better understanding of what to expect in an interview and an increased readiness in giving strong answers. Because this is a hypothetical design for a course, there are no current unusual constraints beyond those a traditional classroom may face.

There will be a detailed syllabus summarizing the course, accompanied by a week's worth of course material. How exhaustive the syllabus will be is not yet determined, but it will contain objectives covering the common interview process and training students about tactics to use while answering the technical questions. The technical component will require students to review the common CS topics that appear in interviews, including some data structures and algorithms. "Core concepts of data structures will be the focus in most every test". Components that may possibly be left out are detailed teachings on how to prepare for the personality component of the interview (University of Chicago, n.d.), where the companies will be assessing if the interviewee is a good personality fit for the company. If there are existing tactics for this, it will be considered to be added to the syllabus, with detailed topics.

The approach for designing a course like this will include finding evidence of the common interview process for the industry. Because the interview process is fairly standardized among the entire industry, gathering evidence should not be difficult. In the event that it is in fact

difficult, a supporting plan will be to gather information from top companies' published guidelines on how the interview process looks for them. Once the interview process is determined, I will research the effective strategies that make a successful interviewee. This information will mostly come from published articles advising readers on strategies to use for interviews.

The deliverable of a week's worth of course material will likely be focused on a specific algorithm or data structure that commonly appears in technical interviews. To prepare the material for this specific topic, the actual topic itself and its appearance in an interview will be researched, as well as what the interviewee should do with the topic during an interview. I intend to choose this as my week's worth of course material because data structures and algorithms will likely be the bulk of the course. This, it will be a useful example on how to teach other topics in the course, and will translate easily to teaching other topics.

Upon completion, I anticipate having a detailed syllabus that summarizes the most important topics a student should train in to excel in a software engineering interview. This will lay out the important topics that the theoretical course should teach. Supporting this syllabus will be a week's worth of course material, that will likely focus on a specific topic to be covered in this course. This will provide an example of how the course should be taught, such as the structure of the homeworks and lecture content.

The Diversity Disparity in the Coding Industry

How have advocacies in the U.S. promoted CS skills and careers among the industries, underrepresented groups?

The computer science industry has long been criticized for its lack of diversity within the workforce (New York Times, 2014). Society's increasing reliance on the software built by major tech companies raises concerns that their dominantly white-male workforce will build in flawed biases into the technology underlying their systems (Metz, 2019). One approach to understanding this problem is to understand the origins of the diversity disparity and take action on closing the diversity gap. For example, specifically within universities, in 2015, data collected from the Center for Education Statistics shows that there is a significantly large difference between how many white males select computer science majors and other ethnic groups (Myers, 2018). There are many active efforts to shed light on the problem and create action for improvement.

One of the problems associated with the diversity gap in CS has been found to be a willingness to try coding. Research done by McKinsey surveyed 2400 interviewees including students, their parents, recent college grads, and employees working in CS related industries found that of the 91% of females who are aware of CS, only 44% are willing to try it. Similarly, only 53% of blacks and 54% of Hispanics. The results convey a challenge that is to inspire more students to want to try computer science. Another challenge found by this survey is how confidence in CS ability differs among males and females. Among ethnicities, "some 50% of blacks and 42% of Hispanics say they believe they would be good at working with computers, compared to 35% of whites and 35% of Asians". However, females' confidence levels are roughly 70% of males. These results convey the challenge of seeking to increase females' confidence in CS abilities. Another challenge has to do with formal access and personal networks. In respect to ethnicities, 27% of black students and 24% of Hispanic students say they know a CS professional compared to 30% and 37% of whites and Asians, respectively. For females, males are 1.5 times more likely to know somebody working in the field than women,

because of how young men's social circles develop at a young adult age. Finally, one last challenge is the negative perception of the CS field itself differs among genders. Females are 2.5 times more likely to have said working in tech is "boring" and "not like me". Additionally, women drop out of pursuing computer science at every stage of the journey at 1.2 to 1.7 times higher than their male counterparts. However, because the research suggests that this trend does not happen in other countries (such as Brazil and India), this phenomenon may have a cultural cause. Among the 73% of American girls familiar with the engineering profession, 33% say they are attracted to it. In contrast, while only 53% of Brazilian girls are aware of engineering, 72% of those aware of it are interested in working in the field (Colby, 2017).

One of the most important participants in closing the diversity gap within the industry is the industry giants themselves. For example, Google states its diversity strategy as "by building a workforce that is more representative of our users and a workplace that creates a sense of belonging for everyone, we are building a better Google - together" ("Google Diversity Report", n.d.). One of their efforts in helping increase diversity in their office is by offering college students internships designed specifically for underrepresented groups (Google, 2020). Similarly, tech-giant Facebook offers a similar diversity internship program, Facebook University (Facebook, 2020). These internships are a single effort among many others in helping underrepresented groups reach the industry by paving a path for them. However, problems still persist in these companies, as it is largely an ongoing effort. For example, Google had 4.8% black hires in 2018, compared to 5.5% in 2019. Latinx and female employees saw a dip in hiring, dropping from 6.8% to 6.6% in and 33.2% to 32.5%, respectively, from 2018 to 2019. However, promising signs are that the internship programs have grown to include 40% females and 24% black and Latinx (Umoh, 2020).

Because many of the employees from these companies receive their training from universities, the BRAID Initiative teamed up a category of participant groups, universities. In the BRAID Initiative, 15 university CS departments created an agenda to commit to implementing an increase in participation of students from underrepresented groups (AnitaB.org, 2020).

Further down the ladder, the organization *Code.org* has created an agenda to focus on diversity and equity in computer science in the grades of K-12. They have done so because they believe that K-12 is "where the problem begins", and a student's opportunity should not be limited by "their family income, or the neighborhood they grow up in…" (Code.org, 2020).

A non-profit organization, *uCodeGirl*, has created an agenda to focus on primarily one underrepresented demographic in the industry that makes 18% of all computer science graduates, females. They believe that it is important to foster a community to help young girls create pathways to technology careers (uCodeGirl, 2018).

References

Build for Everyone. (2020). Retrieved November 03, 2020, from https://careers.google.com/programs/bold/

Code.org's approach to Diversity & Equity in Computer Science. (2020). Retrieved October 08, 2020, from https://code.org/diversity

Colby, S. (2017, April 24). What It Will Take to Make the Tech Industry More Diverse. Retrieved November 03, 2020, from https://hbr.org/2016/03/315-global-digital-ic-diversifying-the-tech-industrys-talent-pipeline

Computer and Information Technology Occupations : Occupational Outlook Handbook. (2020, September 01). Retrieved November 03, 2020, from https://www.bls.gov/ooh/computer-and-information-technology/home.htm

Csorney, L. (2013, April). Careers in the growing field of information technology services. Retrieved November 03, 2020, from https://www.bls.gov/opub/btn/volume-2/careers-in-growing-field-of-information-technology-services.htm

Facebook University. (2020). Retrieved November 03, 2020, from https://www.facebook.com/careers/students-and-grads/students

Inspire . Innovate . Lead. (2018). Retrieved October 08, 2020, from https://www.ucodegirl.org/when-where

University of ChicagoMasters Program in Computer Science. (n.d.). Retrieved November 03, 2020, from https://masters.cs.uchicago.edu/page/technical-interviews-technical-test-phone-interview

Shallit, J. (1995, June). A Very Brief History of Computer Science. Retrieved November 03, 2020, from https://cs.uwaterloo.ca/~shallit/Courses/134/history.html

Silicon Valley's Diversity Problem. (2014, October 04). Retrieved November 03, 2020, from https://www.nytimes.com/2014/10/05/opinion/sunday/silicon-valleys-diversity-problem.html

Support the BRAID Program and Women in Technology. (2020, August 26). Retrieved October 08, 2020, from https://anitab.org/braid/

Umoh, R. (2020, May 07). Google Diversity Report Shows Little Progress For Women And People Of Color. Retrieved November 03, 2020, from https://www.forbes.com/sites/ruthumoh/2020/05/05/google-diversity-report-shows-little-progress-for-women-and-people-of-color/?sh=7b17f686207f