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Infusing Inclusion, Diversity, and Social Justice into the Undergraduate Computer Science Curriculum at Boise State University

Donald Winiecki
Boise State University

Noah Salzman
Boise State University

Timothy Andersen
Boise State University

Amit Jain
Boise State University

Dianxiang Xu
Boise State University

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Prof. Donald Winiecki PhD, Boise State University

Don Winiecki, Ed.D., Ph.D. is the 'Professor of Ethics & Morality in Professional Practice' in the Boise State University, College of Engineering. He teaches undergraduate and graduate courses in 'Foundational Values' and 'Professional Ethics' in the Computer Science Department and Organizational Performance & Workplace Learning Department in the Boise State University College of Engineering. His research focuses on technology-in -use as an influence on social morals and social ethics.

Dr. Noah Salzman, Boise State University

Noah Salzman is an Assistant Professor at Boise State University, where he is a member of the Electrical and Computer Engineering Department and IDoTeach, a pre-service STEM teacher preparation program. His work focuses on the transition from pre-college to university engineering programs, how exposure to engineering prior to matriculation affects the experiences of engineering students, and engineering in the K-12 classroom. He has worked as a high school science, mathematics, and engineering and technology teacher, as well as several years of electrical and mechanical engineering design experience as a practicing engineer. He received his Bachelor of Science degree in Engineering from Swarthmore College, his Master's of Education degree from the University of Massachusetts, and a Master's of Science in Mechanical Engineering and Doctorate in Engineering Education from Purdue University.

Timothy Andersen
Amit Jain, Boise State University

Amit Jain is an Associate Professor and Associate Chair of Computer Science Department in the College of Engineering at Boise State University. He is passionate about introducing computer science to students and has served as the coordinator for Computer Science I course. His research interests include parallel computing. He has worked with ten different departments and several private companies with research funding from several agencies. He has also served as the Chief Scientist for Balihoo, a Boise software company. He holds a PhD in Computer Science from the University of Central Florida and a B.Tech. in Computer Science & Engineering from the Indian Institute of Technology, New Delhi.

Dianxiang Xu, Boise State University

The Computer Science Professionals' Hatchery at Boise State University: Incorporating Inclusion, Diversity and Social Justice into the Computer Science Curriculum

Don Winiecki, Ed.D., Ph.D.
Professor of Ethics & Morality in Professional Practice
Department of Organizational Performance & Workplace Learning
Department of Computer Science
Boise State University, College of Engineering

Noah Salzman, Ph.D.
Assistant Professor
Department of Electrical Engineering, and IdoTeach
Boise State University, College of Engineering

Timothy Andersen, Ph.D.
Professor
Department of Computer Science
Boise State University, College of Engineering

Amit Jain, Ph.D.
Associate Professor
Department of Computer Science
Boise State University, College of Engineering

Dianxiang Xu, Ph.D.
Professor
Department of Computer Science
Boise State University, College of Engineering

Introduction

In the summer of 2016, the Boise State University Computer Science (BSU CS) department was a recipient of a grant from the National Science Foundation (NSF) under the program titled `Revolutionizing Engineering Departments` (RED).[1] In our proposal, we documented our very unique position as a well-established computer science department that has just expanded the number of tenured and tenure-track faculty nearly two-fold, that has an excellent relationship with area industries that commonly employ BSU CS graduates, and a strong desire to increase enrollment and retention of students who are members of traditionally underrepresented groups in Computer Science education and Computer Science professions. With a nod to the industry of fish hatcheries in Idaho, we named the project `Computer Science Professionals' Hatchery` (CSP-Hatchery) with the idea that the BSU CS department serves as a sort of engineered ecosystem in which we can nurture and steer our students toward particular strengths and needs, before releasing them `into the wild` upon graduation. Appendices display concrete examples of selected classroom tools and curricular materials in use to support innovations described in this article.

1 Since that time, while the `RED` acronym has been retained, the full name of the program has been expanded to `Revolutionizing Engineering and Computer Science Departments`.

Members of the CSP-Hatchery team include:

- Timothy Andersen, PhD, Professor, BSU CS
- Amit Jain, PhD, Associate Professor, BSU CS
- Dianxiang Xu, PhD, Professor, BSU CS
- Noah Salzman, PhD, Assistant Professor, Electrical Engineering & Engineering Education (IdoTeach)
- Don Winiecki, EdD, PhD, Professor of Ethics & Morality in Professional Practice, College of Engineering, BSU, and Professor, Organizational Performance & Workplace Learning, [Social Scientist]
- Carl Siebert, PhD, Assistant Professor, Curriculum & Instruction (Education), [Outside Evaluator]

As required by NSF, the project team included experts in engineering education and social science, as well as an outside evaluator who was not involved in the interventions to be included in the project.

Many of the technical and professional needs and strengths we wished for our students came from a series of workshops with the `Industry Council` advising the BSU CS department. Through working lunches, we conducted focus groups to identify technical, business and social skills desired by members of the council. In subsequent development meetings, the desired technical and professional skills were concentrated into a series of one-credit courses we called `Hatchery Units`. Identification, design and delivery of new Hatchery Units is ongoing.

Arising from a clear emphasis both nation-wide and locally on attracting and retaining members of underrepresented groups, the CSP-Hatchery team agreed upon a distributed approach that included both a one-credit course to be called `Foundational Values`, and embedding into courses across the curriculum, instructional and project components that would situate critical social, professional and business ethics and morality into the practice of learning and performing computer science—particularly issues of inclusion, diversity and social justice. Our goal is to ensure that students graduate with a clear idea that a professional computer scientist knows, values and applies particular ethical and moral orientations to every aspect of one's work as a professional, as a technical expert, a team-member and a member of society.

While technical knowledge and skills are commonly considered paramount in any engineering field (and it should go without saying that this includes computer science), this manuscript focuses on our efforts toward achieving the goals associated with ethics, morality, inclusion, diversity and social justice. To a large extent, it is a gloss written from the author's first-person perspective as the social scientist on the CSP-Hatchery project team, and individual most directly responsible for preparing and delivering (or ghost-writing) relevant curricula and supporting other faculty in incorporating professional, context-aware and responsive social ethics across the BSU CS curriculum.

Background: Not `the way it is,` but `the way we have allowed it to become`

The fact that groups other than white or Asian males are not well-represented in either education or professions related with computer science is well documented [1]. Research has shown that popularly-held notions accounting for this are inaccurate or simply false – including lack of aptitude in maths and

science, lack of interest, lack of competitive spirit, preferences for `social activities,` and more – [2]–[4]. Instead, the expression of biased socio-cultural values is asserted to account for the observed fact that women and members of other groups experience pressures from other students and other professionals that influence – often negatively – their pursuit of careers in engineering and computer science [2], [5]–[9].

While at one time, computer science was seen as a profession that was both welcoming and open to diverse membership [10]–[15], this vision was either never realized or quickly lost [16]–[19]. Cultural and gendered expectations (what everybody `knows` and commonsensically `performs`, but few actually think about) that have been part of the lived reality of this technological society seem to have found their way into computer science, and it is not working in everybody's favor. Faced with claims that computer science's `face` as stereotypically white or Asian, and male, is somehow reflective of a sort of evolutionary inevitability – `that's just the way it is` – we instead present that this `face` of computer science is instead `how we have allowed it to become`.

Ideas: Effecting changes from the inside-out, without ignoring other angles

At present, private and public efforts to attain equity and social justice in computing education and professions remains strong, although not uniform, across the field. Most often, these efforts are focused on top-down initiatives to attract and retain a more diverse set of students and professionals in computer-science education and computing professions. However, these efforts have shown limited success in changing the demographics in education or in professional work [1], [2], [7], [10], [12], [14], [18], [20]–[23]. With support from industry, in the Boise State University CSP-Hatchery, our efforts are aimed at changing the culture from the bottom-up, however, with support from the top and the middle.

1. Helping future professionals get a sense for the issues: Students

Our interventions for students are initiated with a one-credit `Foundational Values` course required for all for first-year computer science students. In this course, students encounter real-life case examples of bias in interpersonal and corporate interactions, and bias as reflected in the products of professional practice by computer scientists. The course schedule requires students to attend two, 75-minute sessions per week.

At present, the case examples investigated by students include the following:

- Susan Fowler's experience as a female computer engineer at Uber [24]–[26]
- James Damore's `memo` about diversity at Google [27]–[31]
- Pro-Publica's investigative journalism on current dangers of machine learning applied to policing and criminal justice (and related cases) [32]–[36]
- Computer-based sensing systems that exhibit things that would be labeled as racist if they were performed by humans [37], [38]

All of these cases and the readings and videos supporting in-class investigation of issues, are drawn from popular media, including highly regarded news organizations and more recent social media

venues like Medium, YouTube and the like[2]. These sources – rather than academic, peer-reviewed publications – are used for two reasons. First, this is a one-credit course offered to (mostly) first-year students, with the goal of altering or refining values with respect to morality and computer science, rather than producing refined knowledge and skill. Second, this course aims to help students recognize important issues in the media sources they read and view now, and will encounter for the rest of their professional lives. We think it is neither fair nor appropriate to ask first-year students – in what they overwhelmingly believe to be a technical field – to make sense of and use academic research on this topic. We also want to provide our students with practice in using media reports they will encounter everyday in a manner that influences their day to day practice.

The structure students are presented with to guide their investigation and work toward addressing the issues of each case follows a rubric based on the social-justice theories of John Rawls [39] (see Appendix A). To help familiarize students, a fictionalized example of issues of inclusion, diversity and social justice in computer science education is used as a warm-up, to (a) show what is to be identified and how it can be encoded, (b) apply key vocabulary and conceptual relationships, and (c) demonstrate how they can proceed through subsequent case examples in the course (see Appendix B).

These cases are investigated in small teams (3-5 members), one topic per week, in a five week course. In the first week students are led through an interactive lecture-discussion/focus-group to investigate issues in the fictionalized example included in Appendix B, and shown the worked-out example produced by the instructor (also the author of this manuscript), also shown in Appendix B.

In subsequent weeks of the course, during the first class of the week the instructor leads students through a similar investigation of case examples (listed above), helping them to identify principal issues of ethics, professional morality and inclusion, diversity and social justice as can be identified in the case. These are outlined on the whiteboard of the classroom, with students encouraged to use their own computers to begin filling in elements of the rubric (Appendix A). The instructor uses not only details of the case under investigation in the discussion, but introduces related examples that come from academic literature, other popular media and authentic examples provided by faculty in the computer science department.

The second class period of each week is an open-ended laboratory in which student teams continue working together to produce a completed Social Contract Building Blocks rubric (Appendix A, Appendix B). During this session, the instructor moves from team to team, reviewing their draft materials, offering suggestions and coaching. At present, students use shared access to a GoogleDocs word processing document to produce the culminating product. In the closing 15 minutes of this class period, each team debriefs the class on the main elements of their completed rubric. Assignments are submitted to the instructor by sharing the GoogleDoc for grading. Marks and feedback for each assignment are completed following the scoring rubric in Appendix C.

The product of these projects is both (a) a set of social-contract statements identifying personal and organizational responsibilities and aims of addressing the issues present in each case, and (b) practice toward the development of social and intellectual habits for addressing similar issues as will be faced throughout an individual's education and professional career. As glossed below, these same rubrics and specially-prepared activities are applied in subsequent courses through the undergraduate curriculum.

2 Regardless, the authors of some of these media are standout professionals or rising-stars in computer science and related fields.

Team contributions in each Social Contract Building Blocks assignment are assessed in a peer-wise rating using the template provided in Appendix D.

In addition to scores from Social Contract Building Blocks assignments, and peer ratings, an ongoing series of interviews with students over their experiences in the Computer Science program is being conducted in order to provide a different view of what students are willing and able to do after the course, and to identify additional examples and issues that could be incorporated into the course in the future.

By beginning the computer-science curriculum with a course that (a) guides students in identifying common examples of bias in computing professions and products and (b) acting to develop interventions through which *they themselves* will be able to address those issues in their education and professional pursuits, we aim to help students change the culture systemically but starting from the bottom-up. By diffusing this same set of activities through the undergraduate curriculum with consistent tools and process, we aim to help students develop (a) a broader understanding of what constitutes bias in professional and social life, and (b) intellectual habits and supporting skills to address it in a systematic and thoughtful way. Taken together, we aim to provide a consistent and usable scaffold of values and practices with which students will find a way to become agents of change in the culture of computer-science education and professional practice.

All of that said, this is still a dynamically-moving process! The `Foundational Values` course is new as of fall semester 2017. It is intentionally focused more on issues of morality (commonsense or `unthought` issues of right and wrong), inclusion, diversity and social justice. Another required course offered at the 200 level addresses more conventional issues of `Computer Ethics` – copyright, intellectual property, as well as a more detailed review of ethical theory along with application examples. We are currently in the process of more carefully aligning these courses. However, even now, students who have taken both courses indicate that they `go together well`, and especially that the issues and projects and tools provided in `Foundational Values` are of almost immediate use in the 200 level `Computer Ethics` course.

While just beginning, interviews with students who have completed the `Foundational Values` course report positive outputs of the course, expressing surprise (sometimes happy surprise), that computer science is *not just a technical field*, and that their new or evolving ideas about the issues introduced in class have given them more reason to pursue computer science as a profession. As one might expect, there are also students who are either not quite ready to fully take on these concepts, or outright hostile of them.

2. Identifying and focusing on issues of ethics, morality, inclusion, diversity and social justice across the curriculum: a sense for the main issues: Faculty

It may not come as a surprise to learn that some (if not many) computer science faculty members believe that their courses include `purely technical content` that has no connection with ethics, morality, or issues related to inclusion, diversity or social justice. Anecdotally, it can also be argued that – with striking exceptions emerging in the field – faculty members in computer science most likely do not have expertise in those areas.

From the beginning of this project, I can also report that some faculty may be wary or even threatened by the prospect of incorporating such content into their courses. The most forceful example of this came during a presentation at a faculty meeting in which the author of this paper reviewed related research on diversity in computer science and the reported experiences of members of underrepresented groups in higher education and in professional practice – issues including microaggressions, stereotype threat and more – [10], [11], [40], [41] followed by an exercise in which all attendees were asked to complete the `Gender-Science` version of the Implicit Assumptions Test (IAT) <https://implicit.harvard.edu/implicit/>. The follow-up discussion was diverted by one faculty member who impugned the credibility of the IAT itself[3] effectively changing the intended topic of the session to (a) a general movement against social science and (b) the common view that computer science is itself `purely technical` and not affected by issues now associated with bias, lack of inclusion, diversity and social justice. Had this same discussion been attempted today, it would be appropriate to point out recent events including Susan Fowler's experiences at Uber [24], [25], and the situation at Google, as characterized in James Damore's internal memo and following events [27]–[29], [31] – the latter including topics which are reviewed and refuted in Ceci, Williams and Barnett [2], an article published a full seven years before these events.

From this experience forward, we reduced (for the time being) our efforts to incorporate curricular additions related to morality, ethics, inclusion, diversity and social justice across the curriculum, and concentrated our efforts to ensure these content areas were included in the gradually increasing array of `Hatchery Unit` one-credit courses. Our strategy is to show by example, how these content areas can be incorporated into what are otherwise considered to be `purely technical courses` both unproblematically for the faculty members and with real-world impact for students.

To date, three of these one-credit Hatchery Units have been planned (Agile Programming Methods; Database Systems; and Navigating Computer Systems), with one (in addition to the Foundational Values course) being offered in the fall 2017 semester (Agile Programming Methods). Future Hatchery Units include topics related to machine learning, algorithms and data science.

Each of these courses takes a different approach.

Agile Programming Methods

This course addresses the dynamic and recursive practice of identifying, defining and accomplishing working code for emerging needs in a software development process. Within the agile process, `User Stories` require that developers understand the end-users' needs and orientations before beginning coding and the dynamic `Scrum` process serves as a pressured, time-stressed and necessarily highly-collaborative venue where programming has to be accomplished. Each of these elements of the agile process serve as model opportunities for introducing and exercising students on aspects of ethical and socially-just treatment of team-members, and careful consideration of how products might affect end users.

3 It is a fact that the methodology used in the IAT are questioned by other psychologists on several aspects of validity, and who assert that it is not able to predict any behaviors <https://en.wikipedia.org/wiki/Implicit_Association_Test>. In fact, the authors of the IAT do not claim it has predictive validity [42].

Database Systems

Envisioned as an entry-level course on SQL, focus on the organization of data and the content of data allowed the instructors to identify readings and personal experiences related to how simple queries can end up producing ethically-questionable situations. For example, databases themselves are shown to be never independent of social context through the example of IBM database equipment being sold to and used by Nazi Germany in the Holocaust. More contemporary examples of databases including legally restricted content like personal health information (PHI, as restricted by the USA HIPAA law), and use of databases of information on underage individuals in social media corporations.

Navigating Computer Systems

Envisioned as a course that would act as a leveling experience for students to acclimate them to the Linux operating system, it programming toolchain, and overall system maintenance, the lead instructor of this course drew upon personal experience as a systems administrator to prepare brief case examples of ethical dilemmas associated with violations of license agreements for development software, contractual limits on the ability to update systems software to protect against zero-day exploits that endanger security of proprietary information across the network. Students assess the dilemma and risks posed to the company and its members, clients, and the individuals whose data are stored in endangered databases.

In each of these cases, in addition to status as tenured faculty, the author of this paper acts as an assistant to other computer science faculty to assemble and/or create materials, assessment instruments and grading rubrics. This is aimed at (a) allowing faculty members to *be the subject matter expert* with respect to the main curricular focus of the class, while also (b) being the `face` that represents content with respect to professional ethics and morality, and inclusion, diversity and social justice, thus providing what we believe to be a more appropriate way of representing the necessary confluence of technical skills and social values. This supportive role is also intended to (c) reduce stresses on current computer science faculty so they are not also expected to learn new content, while at the same time ensuring that new content and materials are systemically-oriented to the overall goals of the CSP-Hatchery project, with respect to issues of ethics, morality, inclusion, diversity and social justice.[4]

Test Runs for Faculty

Since these courses have come online, the first author of this manuscript has also been asked to present guest lectures to their courses, on issues of ethics, morality, inclusion, diversity and social justice as they relate to the specific topic of the course. To date, these have been accomplished in Computer Science courses dedicated to algorithm design, and machine learning, and in courses offered by the Departments of Mechanical & Biomedical Engineering, Material Science & Engineering, and the Undergraduate Core Curriculum in Engineering at Boise State University.

Looking Forward

4 At the present time, the Computer Science department is investigating the possibility to provide the author of this manuscript with more official links to the Computer Science department so that there can be more timely and comprehensive support for faculty in computer science toward meeting the goals of the CSP-Hatchery project.

Offering a one-credit `Hatchery Unit` on the *Foundational Values* that we expect students to acquire and demonstrate in their schooling and eventually in professional practice is only a beginning. Inserting content that reflects and exercises these values across the computer science curriculum is aimed at demonstrating to students the full (or `closer to full`) scope of how those values apply to their schooling and practice, and to give them practice in acquiring and performing those values. In effect, we aim to dovetail both technical and ethics and moral content across the curriculum in such a way that they all appear as necessary and essential components of success in computer science.

Much of this effort is made possible by resources that come from the NSF `Revolutionizing Engineering and Computer Science Departments` grant, and the concept of a CSP-Hatchery. One of the principal innovations (and risks) of BSU CS's project comes from commitments allowing the author of this manuscript to become a major part of the process of infusing issues of ethics, morality, inclusion, diversity and social justice across the curriculum, so that computer science faculty can remain focused on the more stereotypically `computer science` aspects of their teaching and research.[5]

Assessing the effectiveness of these efforts is being accomplished primarily through the work of an external evaluator making use of both formative and summative evaluation techniques. However, an ongoing series of interviews with faculty, and students as they proceed through their studies, is being undertaken in order to provide an `inside out` view of their experience. These interviews will allow us to tell many stories – perhaps more importantly, a story that details the many different things we are doing in order to produce sustainable change for our many constituents.

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5 Having said that, some faculty *do* already incorporate some of these issues into their teaching and research.

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Appendix A: The *Social Contract Building Blocks* Rubric

Name of each team member:

Week (circle one): 2 3 4

Item	Requirement	Description	PCG[6]	Points
1	What's wrong here? State and describe the issue this contract statement is trying to address	Include: • What is the situation (e.g., in team interaction, in professional interaction, in social interaction, etc.)? • What is happening (e.g., what is being highlighted, what is being hidden, what is being done?) • Who is least advantaged? (i.e., member(s) of what status group?) • Who is most advantaged? (i.e., member(s) of what status group?) • What factors are being promoted that are producing a problem? • How does the affected individual(s) characterize the issue? NOTE: there is probably more than one issue in the situation, and there are probably different ways that individuals are advantaged and/or disadvantaged	1	4
2	What rights and duties are to be accepted by stakeholders? Note that the focus of rights and duties should be on (a) ensuring equality for individuals and (b) improving outcomes for the group.	Include two lists: • List 1: things that individuals (who are the focus of the issue) could do to help address the situation (e.g., pointing out the implied issues, acknowledging possibility of unintended harm, participating in coaching the perpetrators, etc.). • List 2: things the (perpetrating) individuals could do in response (e.g., acknowledge the issues identified are problematic in terms of the well-being of the whole group; in terms of keeping focus on relevant factors, etc.).	2, 3, 4	4 4
3	How will the items identified in the two lists above help to improve the overall opportunity for those least advantaged?	• Describe how the listed items (#2, above) will improve the overall opportunity for those least advantaged in the situation identified in #1 (above), without harming the ability of others to participate in productive activity.	2, 3, 4	4
4	What incentives, disincentives or resources could be introduced to reduce continual problems?	State and describe things the organization and actors in the situation described in #1 (above) could do to ensure that everyone's opportunity is maintained (you can include the following, but if you do, you should include another idea also – i.e., what other things could be done to reward orientation with the contract statement, and/or remedy violations?).	5	4

6 PCG = Principal Course Goals listed in the syllabus, page 2.

	Note that the focus of any actions should be on (a) ensuring equality for individuals and (b) improving outcomes for the group.	• Organizations have some criteria and process for assessing individual and team performance that are used in annual reviews. List factors that could be added to this process to pull/push individuals toward meeting social contract rights and duties for all? See also DI15 for clues. • Organizations may offer special training or tools to help them known and perform desired technical and social processes. List items that might be added to such training that could then be used as performance criteria in annual reviews.		

Appendix B: Introductory Example and Worked-Out *Social Contract Building Block* Rubric

A Colorful Situation in Class: A Case Example

NOTE: Footnotes in this document provide a glimpse into problems that only get worse as the story unfolds.

In an upper-division course in which a team project was known to be a main activity for the course, a group of three friends (all male students) agreed beforehand to form a team. This group had all gone through many of their CS courses together and gradually developed a relationship where they compared notes from class, shared their code examples and experiences doing assignments. They started planning to enroll together in courses, and when necessary, to give each other full points on any peer ratings of each others' contributions to course projects so they always got better grades, no matter how much each member contributed to the project.[7] This was their third course together as a group. They even hung out together outside of class, gradually developing an unstated but mutually-agreed upon way of interacting with each other both in and out of class.[8]

This group had developed a reputation for sometimes loud and sometimes bawdy interactions with each other. Members of this group were known to be competent coders but sometimes, instructors wondered if they contributed equally or even sometimes held themselves back rather than overshadow other members of the team – as if being part of this group was more important to them than individual development, and sometimes it seemed that one or more members of the group would harshly tease or critique another member when that member started to develop skills that `stood out` ahead of other members – instructors started to wonder if these three students were so comfortable in their group that they actually held each other back.[9]

Early in the semester, the instructor for the course announced that teams had to include four members. Other teams formed quickly, leaving one class member (a female transfer student named Jamie Gray who had only been in the CS program for two semesters, and who the three friends did not really know). Knowing that the CS department had several NSF funded projects to increase the participation of under-represented groups in the major, they agreed to bring Jamie into their team, with confident comments that they could help her out and be `part of the solution` by `welcoming` a woman into computer science.[10] On their way out of the class that day, one of the three friends remarked to another "...we'll have it easy – [the instructor] likes us and we probably won't have to worry about her getting in our way, since girls can't really handle this stuff"[11] Jamie heard the comment, but being new and unsure of how she fit in, didn't say anything.[12]

As the project got started, Jamie asked if the team could schedule regular design and coding sessions in the lab or other places. She volunteered to set up a Git repository for the code, so they could easily collaborate in

7 This is a form of academic dishonesty – they're effectively lying about how well each member has contributed to the project. It's called `free riding` or `social loafing` because some members get credit for their team contributions even if they haven't contributed anything.

8 It may be risky to fall into habits like this. Each course will introduce new ideas that may interrupt old habits. If the team doesn't incorporate these new ideas, they'll always be struggling to develop important skills.

9 Here is a realization of the risk identified in footnote #8. The students aren't trying very hard to increase their skills through collaborative work. (This is something that programmers are expected to do throughout their careers.)

10 It seems here that this team is accepting the new member for a very biased reason – they think they'll get some form of credit in the course just because they have a woman on their team.

11 More evidence that the team has a biased idea about Jamie – the new female team member. This statement strongly suggests an idea that Jamie is not expected to do anything but `be a female member on the team`. It almost suggests that they won't even have to consider her a real member of the team.

12 Jamie might be experiencing what is called `stereotype threat`. `Stereotype threat` happens when someone who is otherwise competent might experience self doubt and start to believe the stereotype being imposed on them.

the technical aspects of the work.[13] She told her teammates that before she transferred into the BSU CS department, she was in a course where they read research reports that indicated how small teams of programmers became more productive and each developed new skills when they worked together at the same time and in the same place, asking questions about design issues and describing their puzzles to each other as they worked – the active collaboration allowed each member to learn from each other and produce a more coherent design because the design was more easily modified and refined to meet emerging needs of the project.[14]

Andy Green – the oldest of the group because he had switched his major to computer science from Maths when he was a junior – replied quickly, "...we've never worked that way. While we do set up a Git repository for our projects we have always just worked independently and compared notes in class or when we bump into each other otherwise.[15] We work best that way." Getting the hint very clearly, and starting to think she doesn't belong here, Jamie didn't press the issue any farther.[16]

Roy Blue – the youngest of the group and a guy who was always working on some projects outside of class and constantly trying to tell the others what he was learning – waited behind when class ended and walked out with Jamie, saying that he'd heard instructors talk about `pair programming` and `agile programming` and "… even if the others aren't interested, I'd like to try what you're suggesting." Andy had already created a Git repository and Roy and Jamie set up a time to meet in the lab the next afternoon, when neither of them had a class.[17]

Over the next few weeks, when Andy was working independently on the project, Jamie and Roy continued meeting in the lab. They liked sitting by the window and the sun that warmed that spot even though the air conditioning was always too harsh. Other students in the lab seemed to leave them alone and they made progress in ways that made it apparent that the others were not keeping up with their code. They decided that they had to talk with Andy and Vince Orange – the fourth member of the team – and tell them about their design ideas and to try to get them to come to the lab with them to work.[18]

When the four of them had arrived for class the next day, in the few minutes before the instructor arrived, Roy called them together and started to describe how much progress he thought Jamie and he were making on the design, and how they thought the team could do even better if Andy and Vince joined them for work sessions: "...it's pretty neat," Roy said, "we come up to a problem in the design where each of us have to make changes in our code to smooth out the problem. We can design and code more easily because we're both there to bounce ideas off each other and make the changes and test them out after committing the code." He added, "And Jamie showed me some tricks to make it easier to use pointers in C – remember how the instructor told us how pointers were really useful but also really tricky? – Jamie has a way to explain it that is better than what the instructor told us!"[19]

Before Roy finished, Andy started talking, and talking fast, "...I've seen all the commits you two have

13 It seems that Jamie does know something about coding. `Git` is a very commonly used tool for maintaining code for programming projects, and trying to organize team-coding and designing sessions means she has learned that the vast majority of coding projects are actually accomplished in highly collaborative team processes.

14 This effectively proves that Jamie knows a lot about productive programming processes. See also footnote #9.

15 Andy is starting to act in a way that proves the team is not interested in learning new skills. See also footnotes #8, and #9.

16 This is starting to look like Jamie is experiencing `stereotype threat` – see footnote #12.

17 Roy appears to see an opportunity to learn some new things from Jamie. He's going behind the backs of Roy and the other member of the team, since they don't seem interested.

18 Terrific that Jamie and Roy are learning new things and making progress through their teamwork. It's also the case that they appear to have gone far ahead of Andy and Vince and it may look like Jamie and Roy are trying to `outshine` Andy and Vince when they thought the team had a stable practice – see the paragraph in which you can find footnote #16.

19 Jamie appears to be contributing a lot to the collaboration between her and Roy! Roy is vouching for her skills and contributions in a way that you'd think would be convincing to his other teammates.

been making in the repository. I thought we would just follow my lead like we've always done![20] I don't know what she's telling you, but I'm starting to wonder if you two are doing more than coding![21] I'm gonna give you both zero points for your contributions on this project![22]" Vince, as usual, kind of backed away from Andy, but didn't say anything as he looked at his cellphone.[23] After a few seconds, Andy blurted, "We've always made out okay. I take care of you guys and you support me.[24] We don't need *mom* around" – shifting his elbow toward Jamie.[25] Vince could see that others in the class were starting to notice and he sat down in his usual chair and tried to look busy reviewing the chapters they were supposed to have read for the day.[26]

Just before the instructor came into the classroom, Andy said, with more than a little annoyance in his voice, "I'm gonna ask to split up this team. You can keep your code and Vince and I will keep going with what I've started." When Andy saw the instructor he turned quickly and marched up to the front of the room and started talking to the instructor, even before she was able to put her books and notes down and log into the network.[27]

20 It looks like Andy is upset that Roy and Jamie have worked outside of the informally-agreed-upon teamwork practice they had always relied on!

21 It is very clear that Andy is making a very inappropriate accusation here. This goes beyond a microaggression, for sure!

22 This statement exposes several things. First, it suggests the team is used to giving each other full points on team contribution scores – Andy may be trying to punish Roy and Jamie for going against what he thinks are the `normal team rules`. Second, if he actually does give them zero points for team contributions, Andy is committing another sort of academic dishonesty by falsely rating Jamie and Roy as contributing nothing to the team's project.

23 Vince has been pretty quiet up to this point, but maybe by backing away he is signaling that he's not really buying the stuff that Vince is selling. Maybe silent-guy-Vince is making a statement with his behavior if not his words.

24 This seems like another allusion to the free-riding practice that the team has done in the past.

25 Another clearly aggressive remark toward Jamie and another one that emphasizes her status as a woman, rather than her skills as a programmer and team-member.

26 Vince seems to want no part of Andy's actions. He just wants to hide...

27 Andy assumes that Vince is still on his side. I'm not so sure. At the same time, if Andy was already aware of Jamie's and Roy's progress, maybe he should have talked to them earlier and asked about their code and process. But see also footnote #18. If they couldn't work things out earlier, then it would probably be a good idea to appeal to the instructor for advice...

Item	Requirement	Description	PCG	Points

1	State and describe the issue this contract statement is trying to address	Include:
		• What is the situation:
		  • College level computer science coursework team project.
		  • Members of pre-existing team with both social and in-class relationship are asked to include a new member – a female transfer student (Jamie) unknown to them.
		  • The department offering courses has programs to increase participation of under-represented groups.
		• What is happening:
		  • The team has a reputation for being outspoken and risk-averse.
		  • Members of the team known for harsh critique of other members who develop skills and `stand out` from the group (metaphysical and moral commitment to harsh treatment as a means of cooperative behavior).
		  • The team is suspected of facilitating `free riding` (giving each other high participation ratings, regardless who does any work on projects).
		  • At least one member of the pre-existing team seems unhappy with inclusion of new member:
		  • Heard uttering dismissive sexist comments about new female member – she probably won't get in our way (metaphysical assumption that women can't, won't or don't contribute)
		  • Suggested that by `welcoming` Jamie they would be seen favorably by the instructor (moral view limiting what is meant by `inclusion`; assumption that simply `going along` will work in their favor).
		  • Jamie asks to try out a new way of working she learned in another school, based on research (a moral duty to contribute what she sees as useful and research-verified knowledge and skill).
		  • A more dynamic and collaborative process – shared responsibility, shared critiques (objective and metaphysical commitment to a new way of working).
		  • Andy pushes back, saying that this is not the way they usually work (metaphysical assertion that `this is how it works`; moral commitment to confrontation and harsh treatment).
		  • Jamie does not contront the issue (moral stance of non-confrontational behavior?).
		  • Roy asks to work with Jamie outside of class and they make substantive progress before deciding to tell Andy and Vince.
		  • Vince pushes back at their efforts (seems to see that Jamie and Roy are working against the norms and against metaphysically-preferred working practices).
		• Who is least advantaged?
		  • Team members who are `free riding` are actually missing out on possible learning opportunities.
		  • Jamie is objectified and blocked from contributing. Taken in the large, this would act against any woman in the system.
		  • Jamie and her suggestions are dismissed by someone on the team because she is a woman.
		  • Jamie is seen as a token who can make the team `look` inclusive and gain favors from instructor because they will appear to help achieve departmental goals (turning the moral ideal of `inclusion` on its head).
		  • Jamie is obliquely accused of `more than coding` with Roy.
		  • Andy sees himself (and the `old team`) as having been undercut (ironically, Jamie's and Roy's collaboration is seen by Andy to have broken the team's prior form of `teamwork` – a defense of Andy's metaphysical beliefs in `how it works`). If all team members did this, team progress might be negative impacted through the system.
		  • Jamie is marginalized through her status as female.
		  • Andy is upset by what he sees as a breakup of what is characterized as
			1	4

Item	Requirement	Description	PCG	Points

		historically successful practice. (No evidence Jamie's and Roy's actions were intended to produce this effect, or that Jamie's actions are gender-based).
		• Who is most advantaged?
		  • Team members who are `free riding` are gaining grade advantage for little participation.
		  • Jamie and Roy seem to have gained the most through a different form of collaboration and different practices; Andy and Vince are `left behind`.
		  • Jamie loses status as a CS-student and emerging professional – she is objectified as a woman – a factor that shouldn't matter to CS success is turned into a tool to undercut her credibility and potential to contribute.
		• What factors are being promoted that are producing a problem?
		  • The `old way` of being a team seems to be Andy's superficial complaint, thinly obscuring his protests over loss of status and gendered dismissals of Jamie (turns Jamie into a villain).
		  • Roy and Jamie work together in what is presented as a research-based `better way`, but maybe wait too long before bringing their discoveries back to Andy and Vince (they didn't negotiate a new process, even with Andy's initial protests – change management is always bumpy).		

2	What rights and duties are to be accepted by stakeholders?
	
	Note that the focus of rights and duties should be on (a) ensuring equality for individuals and (b) improving outcomes for the group.
		Include two lists:
		• List 1: things that individuals (who are the focus of the issue) could do to help address the situation (e.g., pointing out the implied issues, acknowledging possibility of unintended harm, participating in coaching the perpetrators, etc.).
		  • Focus on objective accomplishments
		  • Team members who don't contribute to projects should be rated at a lower score than those who contribute more.
		  • Jamie and Roy could try to get Andy (and Vince) to take seriously their discoveries and their new collaborative practice (a duty to contribute new information, a duty to be inclusive).
		  • Roy and Jamie could foreground the technical gains accomplished from the new collaborative practice, by comparing it to what Andy and Vince accomplished using `the old way` (a duty to contribute new information, a duty to consider new information)
		  • Apologize for working independently from the group – perhaps agreeing to bring new information back to the team more frequently; being more flexible about meeting times so Andy and Vince can join in (a duty to maintain working order, even within a dynamic environment; a duty to participate in productive changes).
		• List 2: things the (perpetrating) individuals could do in response (e.g., acknowledge the issues identified are problematic in terms of the well-being of the whole group; in terms of keeping focus on relevant factors, etc.).
		  • Team members share responsibility for working on projects and each work to improve the overall product. This should include critiquing and/or teaching others on the team when their work could be improved.
		  • Andy can see the situation in terms of educational gains rather than maintenance of some status-quo (a duty to consider new information and new processes that might improve the situation)
		  • Andy should admit his sexist statements and pledge to avoid doing it again (a duty to protect the individual rights of others to be treated equally).
		  • The `old team` members can agree to avoid their reputed harshness in critiquing and constraining each other (a duty to protect individual right to freedom from unfair and unproductive criticism).
		  • The team can agree to listen to new ideas from team members; perhaps agreeing to small `working groups` that focus on specific issues using different approaches and then comparing notes (a duty to pursue new knowledge and processes that can help everyone; a right to have one's work considered objectively).
			2, 3, 4	4
				
				4

Item	Requirement	Description	PCG	Points
		• Team members can agree to hold each other accountable for personal innuendo and attacks (a duty to uphold the rights of others). ** Perhaps the team should seek advice from the instructor if issues continue to be unpleasant for anyone.		

3	How will the items identified in the two lists above help to improve the overall opportunity for those least advantaged?	• Describe how the listed items (#2, above) will improve the overall opportunity for those least advantaged in the situation identified in #1 (above), without harming the ability of others to participate in productive activity.
		• Having team members agree to a duty to maintain professional working practices (collaboratively protecting each other's personal rights as CS-students and emerging professionals) will:
		  • allow team to focus on productive work when norms are challenged.
		  • develop habits of pursuing continuous improvement in both technical products and professional processes.
		  • focus on professional knowledge and skill, rather than incidental personal attributes that don't affect professional knowledge and skill.
		• Harms resulting from identified behaviors are removed, allowing all members to participate as equals, and to gain from contributions of all others.
		• By protecting the individual rights of others, all individuals are able to participate in making a system where everyone has the same status. (Nobody loses status, everyone gains or retains status.)
		• The ultimate outcome would be inclusion, diversity and social-justice that protects every member.
			2, 3, 4	4

4	What sanctions could be exercised to reduce continual problems? Note that the focus of any actions should be on (a) ensuring equality for individuals and (b) improving outcomes for the group.	State and describe things the organization and actors in the situation described in #1 (above) could do to ensure that everyone's opportunity is maintained (you can include the following, but if you do, you should include another idea also – i.e., what other things could be done to reward orientation with the contract statement, and/or remedy violations?). A very appropriate strategy is to pair incentives/disincentives that come from (a) the organization (top-down rules, objective ratings and measures), and (b) individuals (bottom-up,) • Evaluation of individual members and team accomplishment can include honest and fair rating of individual collaborative behaviors (an incentive to comply with rating scheme that encodes particular behaviors considered to support inclusion and social justice). • Project teams could be required to agree to a code of conduct. Violations of the code of conduct are met with some penalty in scoring and grading (a disincentive to avoid a duty to perform according to a code of conduct that encodes particular behaviors considered to support inclusion and social justice). • The organization can offer instruction that provides strategies for identifying and addressing issues of bias that adversely affect individuals and teams (this would be both to clarify the expectations [rules] and provide examples of what constitutes acceptable and unacceptable conduct; *examples of violations could teach and promote use of the veil of ignorance as a tool for assessing or reflecting one's own behavior or observed behavior of others*). • These will establish organizational expectations and a set of incentives and disincentives supporting inclusion and diversity, where everyone has the same rights and duties, and maintenance of those rights and duties allows professional ethics to be a self-fulfilling process.	5	4

Appendix C: Social Contract Building Blocks scoring rubric

SCORING KEY:
Scoring of S-C building blocks assignments will use the following as a general guideline.

Points	General Justification for Scoring
0-10	Description includes **a few** of the requirements,[3] and (a) **sporadically uses** appropriate terminology,[4] if warranted, to: • specify people involved, or • identify and describe problematic issues, or • identify and describe rights and duties, or • identify and describe tactics and strategies that could improve the situation.
12-15	Description includes **most** of the requirements,[3] and (a) **occasionally uses** appropriate terminology,[4] if warranted, to: • specify people involved, or • identify and describe problematic issues, or • identify and describe rights and duties, or • identify and describe tactics and strategies that could improve the situation.
15-18	Description includes **all** of the requirements, and **uses** appropriate terminology, if warranted, to: • specify people or factors involved, or • describe problematic issues, or • identify and describe rights and duties, or • identify and describe tactics and strategies that could improve the situation.
18-20	Beyond the items included in this chart, I will be looking for continuity across each part of the rubric. I will be looking for evidence that item 2 in your rubric is influence by what you have included in item 1, and that item 3 in your rubric is influenced by what you have included in item 2, and that item 4 in your rubric is influenced by what you have included in item 3. Even if you have completed each item to meet the scoring criteria in this chart, if your overall rubric does not reflect continuity across the whole thing, you will not receive high marks.

Appendix D. Peer Participation Scoring Rubric

Rate each of your teammates separately on their participation and contributions toward accomplishment of each of the five Principle Course Goals (listed in the syllabus, page 2, and below). Providing misleading information on this form is considered a form of Academic Misconduct. See 'Policy on Academic Misconduct' in the syllabus, page 6.

Week (circle one): 2 3 4

Write in names =====>	Name of teammate #1			Name of teammate #2			Name of teammate #3			Name of teammate #4		
You learned useful perspectives from teammate today? Very useful! (+2) Seem okay (+1) Nothing new (0) (circle # to rate each)	0	+1	+2	0	+1	+2	0	+1	+2	0	+1	+2
Quality of ideas toward achieving principal course goals today? High quality! (+2) Seems okay (+1) Didn't help us (0) (circle # to rate each)	0	+1	+2	0	+1	+2	0	+1	+2	0	+1	+2
How safe do you feel when you offer ideas, comments or criticism to this person? Totally safe (+2) Not sure (+1) Not at all safe (0) (circle # to rate each)	0	+1	+2	0	+1	+2	0	+1	+2	0	+1	+2
This teammate provided fair share of content and adequate level of proofreading Write YES or NO	YES NO			YES NO			YES NO			YES NO		
If you could offer anonymous feedback (positive or otherwise), what would you want each teammate to know about his or her conduct and performance?												

Refer to the following when rating the contributions of your peers today:

1. **Identify** and **describe** professional ethics related issues in provided case examples, and in situations brought up in the conduct of the class (whole class, team, individual).
2. Given a set of case studies containing ethical violations in computer-science related professional practice, **sort them into a list from worst to least** (team).
   a. **Describe your sort order** in terms of your perception of how those violations affect the ability of all individuals to participate fully in computer science related work (whole class, team).
3. **Analyze** issues identified in #1 (above) by **applying** Rawls' (a) principles of justice and (b) priority rules (team).
4. **Collaborate** to **produce** building blocks for one or more social-contract building blocks for each issue identified, using Rawls' theory of justice (team).
5. **Discuss** and **propose** (a) positive and/or (b) negative feedback for individuals who fulfill or violate your social-contract building blocks.