Assignments that Blend Ethics and Technology

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ABSTRACT

With the 2018 revision of the ACM Code of Ethics and Professional Conduct, there is a growing interest in how computer science faculty can integrate these principles into the education of future practitioners. This special session illustrates one approach by highlighting assignments that blend ethics and technology. These assignments can be used in a variety of courses, including CS1, CS2, and later courses. Presenters will provide an overview of each assignment and gather feedback from the audience. All materials, including descriptions, starter files, and guidelines for instructors, will be published at `https://ethics.acm.org/SIGCSE2020`.

CCS CONCEPTS

• **Social and professional topics** → **Model curricula**; **Codes of ethics**; • **Applied computing** → *Collaborative learning*.

KEYWORDS

ACM Code of Ethics, computing ethics, CS education, pedagogy

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1 OBJECTIVE

The ACM published a revised version of its Code of Ethics and Professional Conduct in 2018 [2] and aims to support the Code through activities that help computing educators to integrate ethics throughout the computing curriculum. The goal of this special session is to adapt the framework of the annual Nifty Assignments session [3] to highlight assignments–designed for both stand-alone computing ethics and traditional core computing courses–that are specifically focused on integrating ethical and technical learning objectives. In this sesssion, five presenters will provide an introduction to their assignments and explain the underlying ethical and technical learning objectives. This overview will include a description of what course or courses the assignment can be used in, what prerequisite knowledge or discussions are needed, and how instructors can assess student submissions. Each presentation will offer a brief opportunity for questions specific to that assignment. After all presenters have shared their assignments (10-15 minutes each), the remaining time will be structured as an open discussion.

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2 OUTLINE

2.1 Cybersecurity Narratives - Stacy A. Doore

This *Computing Ethics Narratives* module, designed for a Computer Networks course, includes learning outcomes where students examine network security through a range of competing narratives, identify conflicts around concepts such as "confidentiality," "honesty," and "loyalty" in relation to network security, and evaluate ways to address potential impact of breakdowns in network security for individuals and society. The module's three lessons ("bytes") feature network security narratives from films, literature, academic journals, and other media. In the first byte, students articulate their initial perceptions about ethical issues that should be considered in network security design. Next, students complete activities revolving around controversial security breech narratives from the perspective of various stakeholders. Students are asked to analyze both the technical and ethical responsibilities involved in secure computer networks, as well as how network security incidents can threaten individual rights and societal freedoms. Finally, students apply their new knowledge to critically evaluate potential vulnerabilities and conflicts of interest related to network security in emerging tech. Changes in student technical knowledge, ethical reasoning, and consideration of multiple perspectives are assessed using short writing prompts, a metric of narrative density, and existing rubrics. *Stacy A. Doore is a Visiting Associate Professor of Computer Science at Bowdoin College.*

2.2 Black Mirror Writers' Room - Casey Fiesler

This assignment uses science fiction [1] as a vehicle to engage students in thinking speculatively about the implications and potential unintended consequences of the technology they or someone else may create. It has primarily been used in a stand-alone computing ethics course, though discussion-based versions have been piloted in CS1 and a user-centered design course. In small groups, students discuss a current technology (social media, recommender systems,

facial recognition, etc.) and then brainstorm (1) what the next iteration of that technology might be; (2) how a bad actor might make use of that technology or how it might otherwise cause harm; and (3) how that technology might be designed to mitigate the harm of or prevent those unintended consequences. After having worked through through this process of creative speculation, students then individually write narratives in the form of a fictional news article that illustrates these consequences in action, and then a reflection about how we might avoid that future. A good lead-in or follow-up for this assignment is looking to examples of ethical issues in science fiction (such as episodes of Black Mirror) and discussing the design choices by technologists that might have led to problem. *Casey Fiesler is an Assistant Professor of Information Science at the University of Colorado Boulder and a Senior Fellow in the Silicon Flatirons Center for Law, Technology, and Entrepreneurship.*

2.3 Gene Sequencing - Michael S. Kirkpatrick

This assignment in our CS2 course blends independent project implementation, an analysis paper, and an in-class discussion. The project implementation involves applying a simplified version of the longest common substring problem, in which the strings consist of sequences of nucleobases to create a synthetic DNA representation. To prevent manual inspection and to illustrate the challenge of scale in algorithms, the sequences are over 3,000,000,000 characters in length, based on the true length of human DNA. In the in-class discussion, students are asked to consider how automated gene sequence analyses can be used for both beneficial (identifying and curing disease) and harmful (discrimination) purposes. Students are asked to consider the questions they may ask if they were employed to do such work. In the analysis paper, students combine an analysis of the complexity of their implemented algorithm and a reflection on the in-class discussion. *Michael S. Kirkpatrick is an Associate Professor of Computer Science at James Madison University and the ACM COPE Education Coordinator.*

2.4 Hiring Algorithms - Evan Peck

While many CS1 courses use course grade book activities to practice loops and lists, a simple manipulation can provide a meaningful, reflective experience. Instead of managing a classroom, we ask students to build a hiring algorithm–one that automatically filters and priorities applicants based purely on their course grades. Pairing tightly with curriculum on lists and loops, we provide a dataset in which each applicant is represented as a list of course grades. In a 2-hour period, students must design, write, and test criteria for determining which applicants are accepted or ignored (will they base it on averages? Max/min grades?). After a period of design, we present students with carefully chosen 'data narratives'–the data of a student who dealt with personal trauma one semester, the data of someone who makes an error in their entry, the data of two students with inverse trajectories, etc. This experience leads questions into key, ethical reflections: What does it mean to design a fair algorithm? What is the human cost of efficiency? What systemic advantages/disadvantages are our algorithms likes to amplify? *Evan Peck is an Assistant Professor of Computer Science at Bucknell University.*

2.5 Information Bubbles - Mehran Sahami

To better understand the dynamics of how information bubbles form and how political polarization can occur in social networks, this assignment provides a small scale simulation of a social network to investigate these phenomena. The simulation allows students to visualize how choices with regard to trying to maximize revenue generated by user activities in the network may lead to a polarization of users. Through this investigation students learn to formulate a strategy for how a social network might make choices with regard to how it recommends content to users to achieve what they believe are the right outcomes for the social network and for society. This assignment includes multiple cases that can be used in various courses in the curriculum. One case–which involves just running the simulation and analyzing the results–can be used in CS1 or discrete math, given sufficient scaffolding in graphs and discrete probability. The others–which involve writing code–are more appropriate for CS2 with a discrete math prerequisite. *Mehran Sahami is a Professor and Associate Chair for Education in the Computer Science Department at Stanford University. He is also the Robert and Ruth Halperin University Fellow in Undergraduate Education.*

3 EXPECTATIONS

The intended audience for this session would include educators, primarily at the secondary and undergraduate levels. The intent of the session is to provide the attendees with enough information to use these assignments in their respective courses with little or no modification needed. In addition to sharing these assignments, this session provides an opportunity for the community to provide feedback through the discussion portions to improve the quality and/or scope of the assignments. A third goal is to invite attendees to become contributers to this effort by creating additional assignments that can be added to a public repository.

4 SUITABILITY FOR A SPECIAL SESSION

This session blends aspects of a panel and a tutorial that would work best as a special session. While each of the presentations explore the issue of how to integrate ethical and technical objectives, the focus is on providing the audience with an overview and tutorial on how to use each assignment. In addition, the discussion portion allows the presenters to incorporate the feedback from the community beyond this session to improve the posted assignment material. Finally, computing educators with little or no background in ethics may not feel confident teaching or assessing these works; a distinct special session that is independent of the Nifty Assignments session will provide an opportunity for the presenters and audience to discuss challenges that may arise with these assignments.

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