

Exploring the Ethical, Legal, and Social Aspects of the Computing Discipline

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Abstract: *Computer science professionals must be prepared to handle ethical, in addition to technical, challenges. Situations in industry demand this -- and the Computer Science Accreditation Board (CSAB) requires that undergraduate programs address it. This paper describes a course which helps prepare students to face these ethical challenges.*

CS 400, Computer Science Seminar, is a one credit hour graded course taken by our computer science majors in their last semester of undergraduate study. The course addresses the ethical, legal, and social aspects of the computing discipline. Students are exposed to some of the ethical challenges they might face in their careers as computer scientists through case studies, assigned journal readings, and guest speakers. We also discuss graduate study in computer science, membership in professional societies and the importance of reading journals to stay current in this fast-moving field.

This paper presents an overview and then describes the implementation of this seminar program.

Overview of the Computer Science Seminar

"Every day on the job, virtually all engineers have to deal with ethical issues of one sort or another." This statement was made by Michael Pritchard, director of the Center for the Study of Ethics in Society at Western Michigan University [1]. The statement emphasizes the need to prepare graduating scientists and engineers to face these ethical challenges.

What constitutes an "ethical challenge"? The answer to this question is not always immediately obvious. We must consider moral norms and the

legal aspects of the situation. If you believe an action is morally wrong, does that make it unethical? Would it be unethical if someone else did not believe it was morally wrong? Is everything which is legal ethical? We must also recognize the uncertainty in cases involving professional judgment. What should you do when, in your professional opinion, there is a significant problem with a product? How do you factor in the possibility that your professional judgment might be incorrect? How do you make trade-offs between *possible* technical risks if the product is released now and *definite* adverse business impacts if product release is delayed?

Our Computer Science Seminar provides students with an opportunity to explore and to practice making decisions about these types of ethical issues in a classroom environment. Students also examine key legal issues and their relationship to computer ethics. These issues are intertwined with the social impacts of computers. A key outcome of the seminar is students' recognition that they might face situations in which there is no single "right" answer. The Computer Science Seminar heightens students' awareness of these issues, and helps students see that they must consider more than just the *technical* aspects of computer science. They must also be able to identify, and then to act on, ethical challenges. The students see the importance of the ability to communicate effectively. Ethical challenges cannot be resolved if the engineers cannot convey the facts, and then their assessments of the situation, to the ultimate decision-makers.

The seminar also provides students with information about continuing their professional development. We discuss graduate study in computer science, membership in professional societies, and the importance of reading journals to stay current in this fast-moving field.

Implementation of the Computer Science Seminar

Schedule and Classroom Approaches

This seminar, which is required for all computer science seniors, meets for one hour a week during the spring semester. This provides about fifteen classes in which to cover this broad subject area. We use a variety of approaches, ranging from case studies and group discussions to invited guest speakers. The exact schedule for the course varies somewhat from year to year. During the 1997 spring term, we had nine guest speakers, one session of student presentations on a number of current journal articles, and five group discussions. Three of these group discussions focused on case studies; one session addressed the students' views of an editorial; the final discussion was a class review and summary. We used Computers, Ethics and Social Values [2], which provides a number of excellent case studies, as our course text.

One of the first challenges we face is convincing students at a school with a strict honor code that they don't already know everything there is to know about the ethical issues they might face in the computing discipline. The honor code, which states that "a cadet will not lie, cheat, or steal, nor tolerate those who do" [3], sometimes leads the students to regard all situations as though they could be divided cleanly into either "right" or "wrong." This provides adequate guidance for some ethical issues. For example, it is not difficult to decide if it is wrong to cheat on an expense account. However, many ethical problems faced by computer science professionals do not fall neatly into these categories. These dilemmas often involve differences of opinion in professional judgment, as opposed to absolute truths. We have found that case studies are useful to demonstrate the potential complexity of ethical issues in computer science and therefore motivate our students.

For example, during the second class, we used a hypothetical case study of George, a quality control engineer working on a flight control system for a new military aircraft [4], as the basis for group discussion. George believes that there are still serious flaws in the system, but his company disagrees and wants to release the software for flight test immediately. Initially, our students considered this a simple case of right vs wrong, and said that George must "blow the whistle" and stop the flight test. However, as we discussed the case in more detail, students gained an appreciation of the true complexity

of the situation. They saw that business pressures are real, and that they can expect to face these pressures in their computer science careers. They acknowledged the importance of communication skills. If George could convince management to postpone the flight test, he would not face an ethical dilemma. We eventually raised the possibility that George might be wrong. Should he risk his job and his company's reputation when his concerns might be unfounded? Many of the students had not considered this possibility in their previous analysis of the situation. They had interpreted George's *concerns* about the system as *absolute truths*, rather than recognizing them as his professional judgment -- which is subject to error. By the end of this class, most students appeared to appreciate the need to investigate computer ethics in more detail.

We discussed several other case studies during the seminar, including the worm released onto the Internet by Cornell graduate student Robert Morris [5, 6]. Several students were asked to describe the facts in the case. Next we discussed whether Robert Morris' actions were wrong, since the worm did not actually destroy any data. Our students had conflicting opinions. Some viewed Morris's worm as an effective way to draw attention to holes in the UNIX security model; others felt that it was clearly wrong for Morris to have designed and released the worm and that he should be held liable for the dollar value of the computing time and man-hours consumed removing it. We concluded this class by asking students whether they would be willing to hire or to work with Mr. Morris and to explain their rationale.

We use two different formats for our group discussions. Some topics are discussed with the entire class (which typically consists of 30 - 40 students). For other topics, the students are divided into groups of five or six. They spend approximately thirty minutes discussing the topic and organizing a short presentation. The course facilitator then selects a few of the groups to share their conclusions with the rest of the class.

We also invite seven to nine guest speakers from diverse backgrounds to talk to the class. These speakers address a variety of topics.

One popular speaker discussed an ethical issue he encountered on a software development project, and what his workgroup did to resolve it. The speaker was a senior Member of the Technical Staff (MTS) on the project. The ethical issue involved schedule and status reporting for that project. Our guest speaker was present at a meeting

in which the project manager was briefing senior executives about the project. The project manager described an "optimistic but feasible" schedule; however, our guest speaker, along with several other members of the development group, found it completely unrealistic.

What should the guest speaker do? Should he disagree with the project manager in front of the executives? Our guest speaker considered that to be inappropriate -- a violation of the team spirit his workgroup had developed. However, he also believed very strongly that the information presented was overly optimistic to the point of being completely inaccurate. He did not know whether it constituted intentional deception by the program manager or simply wild optimism. Our guest speaker found himself torn between his loyalty to his team and project manager, and his loyalty to his company, which had a great deal of money invested in the project and needed an accurate assessment of when it would be done and how much the final product would cost.

Our guest speaker involved the class in a discussion of this situation. Could it have been avoided altogether? The class initially thought that the project manager should certainly have ensured that the people who were going to have to do the work agreed that the schedule was at least somewhat reasonable. This would have allowed them to discuss their differences of opinion within their workgroup, and present a "united front" when they briefed the company executives. However, our students lacked the experience to understand that this is not always possible. Also, once the "optimistic" schedule was presented to the executives, what should our speaker have done? Again, our students' initial reaction, based on their "black or white; no gray allowed" views concerning ethics, was to "do what was right and not worry about the consequences." They thought that the project manager should be stopped immediately, and the disagreements made known -- in front of the executives. They did not consider the likely long-term effects on the team, and the project, if this approach were chosen.

Eventually, the speaker provided our class with details on what had actually happened. The group held a very lively private team meeting, in which the members expressed their concerns and convinced the project manager to produce a less optimistic schedule. This was accomplished, in part, by announcing that the some of the team members would, regretfully, feel compelled to share their view of the schedule directly with the senior executives if the project manager did not produce a more

reasonable schedule on his own. The significantly revised schedule was presented to the executives at a later time.

This guest speaker helped the students appreciate the uncertainty involved in professional judgment, the many non-technical constraints (including team dynamics and budgets) which can affect a project, and the importance of thoughtful and effective communication and coordination.

Student Assignments

Students earn one semester credit hour and receive a letter grade for the seminar. We use several different types of student assignments to enhance learning and help students hone non-technical skills which will be critically important in their careers.

Students are required to prepare three questions to ask the guest speaker or to use in group discussion for each class. At least one of the questions must correctly cite a valid reference. The questions represent 55% of each student's course grade. Since the questions must be typed, students are forced to complete reading assignments and to research the topic before they attend class. These questions also reflect the emphasis we place on exploring open-ended issues, rather than providing potentially over-simplified solutions.

Students prepare a short (3 - 5 page) research paper, which explores an ethical, legal, or social aspect of the computing discipline in more detail. A paper proposal is required two months before the final paper is due. This gives the course facilitator an opportunity to ensure that topics are adequately developed.

Students typically deliver one or two short (5 to 8 minute) small group presentations during the semester. For example, groups of about five students are each assigned a different journal article. They present what they learned from the article to the rest of the class at the next meeting. Students are graded on their presentation structure, their delivery, and the visual aids they prepare, in addition to the quality of the technical content. This activity exercises oral communication skills, in addition to exposing students to the content of several technical journals.

Conclusion

Our Computer Science Seminar prepares participants for the transition from student to computer science professional. The course explores the ethical, legal, and social aspects of the computing

discipline through case studies, group discussions, and guest lecturers. The student assignments reinforce key concepts and exercise essential non-technical skills. The seminar prepares students to deal with complex ethical challenges.

References

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