Humanistic Mathematics Network Journal

Issue 16 Article 15

11-1-1997

A Course In Mathematical Ethics

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A COURSE IN MATHEMATICAL ETHICS

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Summary: *This paper is a report of a course in mathematical ethics that I have developed and taught. The course is designed for math and computer science majors in their junior and senior years. A course outline is given and various projects involving mathematical ethics are discussed. Arguments are presented that ethics is relevant and crucial to mathematicians.*

This paper is based on a talk presented at the national meeting of the American Mathematical Society in San Diego on January 10, 1997.

Longwood College, as part of its general education requirements, specifies that every student must take an ethics course, preferable in the student's major. When the requirement was instituted, I was given the job of developing an ethics course for the Mathematics and Computer Science Department.

Several problems were apparent. First, I had no formal training in ethics. Second, I did not know where to look for material and resources. Third, I had no existing course to use as a model.

Having no formal training in ethics proved not to be much of a problem. I quickly found several books in computer science ethics, and most of them had an introductory chapter or two giving an overview of ethical theory. After reading them I used a member of the Philosophy Department as a resource. I did not become an expert, but today I can hold my own in a discussion of ethical theory.

The second problem, the lack of resources, proved to be more difficult. There is a good deal written about ethics in computer science and the natural sciences, but I wanted something pertinent to mathematics as well. It appears that very little work has been done on mathematical ethics. Indeed, most mathematicians appear not to have thought much about the subject at all. None of the major mathematical societies have codes of ethics for their members. (The American Mathematical Society recently adopted an ethics code, but it is a code for the society, not for individual mathematicians.) Even the National Council of Teachers of Mathematics has no code of ethics. This is in marked contrast to other disciplines.

I was able to develop and teach the course. It has the following assumptions and objectives:

*MATHEMATICIANS NEED TO THINK ABOUT THE CONSEQUENCES TO SOCIETY OF APPLYING THE KNOWLEDGE THEY POSSESS.

*MANY ETHICAL AND MORAL DILEMMAS ARISE IN THE NORMAL COURSE OF A MATHEMATICIAN'S CAREER, AND THE PROFESSIONAL MUST BE ABLE TO RECOGNIZE AND RESOLVE THEM.

*MATHEMATICIANS NEED TO UNDERSTAND THE IMPACT OF ACADEMIC MATERIAL ON THE REST OF SOCIETY.

*MATHEMATICIANS NEED TO HAVE A BETTER APPRECIATION OF THE RELATIONSHIP BETWEEN TECHNICAL ISSUES AND HUMAN VALUES.

Mathematical ethics textbooks do not exist, so I have had to resort to using those written for computer science. [1], [2], and [3] are good ones. While these books are intended for a computer science audience, much of the material they contain applies to mathematicians. Of these, [1] and [3] have excellent introductory chapters on ethical theory. [1] has more material than [3], and both are more directly focused on computer science than is [2]. Unfortunately, some of the readings in [2], while more general, are dated.

The course description from the college catalog is as follows. "Consideration of ethical implications of mathematics and computer science in society. Overview of ethical theory; case studies of situations illustrating ethical dilemmas. A knowledge of calculus and algorithms will be assumed. 1 credit."

The course begins with an overview of ethical theory. This is the first course in ethics for most of the students, and they need some foundation on which to base later discussions. I cover three of the theories which appear to be the most widespread and influential today: utilitarianism, Kantian (deontological), and relativism. I require the students to decide with which of these three they most agree and write a short paper defending their choice. This is not the same as requiring the students actually to believe in one of these three, of course. I regard requiring belief, or imposing my beliefs, to be unethical.

The rest of the course consists largely of readings, discussion, and case studies, with students expected to apply the theories to the cases. Lecture is kept to a minimum. Class discussion and writing are emphasized. The grade is based on class participation, a test, two short (two to three page) papers, and a longer (five to six page) paper requiring some research, in which the student is expected to analyze an ethical dilemma pertaining to his or her intended career involving mathematics. The calculus and algorithms prerequisites for the course are mainly for maturity. Most of the topics can be understood even by those who are mathematically weak.

A big challenge is to make sure the course contains material of interest to mathematicians; the temptation is to take the easy way out and use the readily accessible material that applies primarily to computer science. Fortunately, many topics naturally overlap the two disciplines. Professional obligations, including "whistle blowing" and complete disclosure; intellectual property rights, including copyrighting issues; and matters involving improper use of data, whether to invade privacy or to draw misleading and unsubstantiated conclusions, are examples of issues involving ethical dilemmas that are likely to be faced by mathematicians as well as computer scientists.

It is difficult to find good case studies pertaining solely to mathematical ethics. I have found two topics that may be used successfully in a course. The first concerns the ethical implications of patenting algorithms. Is it ethical to patent a problem solving method and to make others pay for use of one's intellectual products? Suppose, for instance, that you find a new, faster way of solving the Traveling Salesman Problem, a discovery that has great economic implications. Are you ethically justified in patenting your method and charging others for its use?

The second topic has to do with censorship. Two decades ago the National Security Agency (NSA) tried to require mathematicians working on cryptography to submit their work to NSA prior to publication for censorship, arguing that allowing America's enemies access to powerful techniques for making and breaking codes could be devastating to national security. Today there is great controversy over the export of American products involving sophisticated encryption schemes to foreigners. If you are doing research in cryptography, do you have an ethical obligation to submit your work for censorship - or are you ethically obliged not to do so?

I believe that this course is one of the most important mathematics courses that the majors take. Mathematicians possess powerful knowledge, knowledge that can have tremendous effects on other people and on society, and I believe we have a moral obligation to use it wisely. I am very concerned that few mathematicians think about the consequences of what they do, and I believe we must provide a framework for our students to use as they make professional decisions in their careers.

REFERENCES

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