Course Title. “Cultural Oddities and Ethical Implications in the Mathematical Sciences.”

Meeting Times. Section EG1 (CRN 59918) will meet on Mondays, Wednesdays, and Fridays from 12:30 PM through 1:20 PM in MSEE B012.

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Course Overview. As introduced in the early 1950’s, “the Great Issues course for seniors in the School of Humanities, Social Science and Education [...] has the general purpose of serving as a ‘bridge’ between formal college courses and the continuing study and consideration of major issues by responsible college graduates. The objectives are to develop a sense of perspective in, (a) recognizing that men have faced similar issues through the ages, and (b) that no panaceas exist for settling human problems once for all; to bring together the thinking of people of broad experience, varying points of view, and diverse backgrounds in seeking ways to meet the questions which demand attention in public affairs, and to develop an awareness of unity in knowledge and of the interrelationships of problems in various fields of activity and interest.”

This is a great time for there to be a “Great Issues” course in the mathematical sciences. The past few years have seen a renaissance of the popularization of mathematics. Indeed, the syndicated television show Numb3rs caught the attention of many high school students, the young Fields Medal winner Terry Tao has a weblog which seeks to blend various areas of research through rigorous prose as stream-of-consciousness, and the award-winning author Steven Strogatz had a weekly column in the New York Times which rhapsodizes the joys of math to the uninspired. Between headline news regarding wire-tapping by the National Security Agency and Grigori Perelman’s refusal to accept a $1 million prize for his research, mathematics pervades within popular culture like never before.

Course Objectives. Keeping with the original theme of “Great Issues,” the main objectives are

• to analyze the culture of computer science, mathematics, and statistics as viewed both in mass media (e.g., magazines, periodicals, and television) and specialized discourse (e.g., conferences, journals, and seminars); and
• to codify the moral obligations of mathematical scientists both to professional colleagues (e.g., faculty, researchers, and students) and nontechnical laypersons (e.g., classmates, friends, and relatives).

Course Structure. Each class period will have one of more of the following:

• Outside speakers to provide a real-world perspective of the topic.
• Debates and discussions among the students.
• Student presentations on research topics to provide background for discussions.
• Reviews of reading assignments which will include periodicals and expository journal articles.
• Reviews of writing assignments to stimulate reflection.

Prerequisites. Course registration by permission of the instructor only.
Course Description. We will on the following five key questions:

- **If you personally do not understand the proof of a mathematical statement, is that statement still true?** In 1993, Andrew Wiles announced he would publish a proof of Fermat’s Last Theorem. Marilyn vos Savant, listed in the Guiness Book of World Records as having the Highest I.Q., published a book the same year entitled “The World’s Most Famous Math Problem” which claimed such a proof had to be false because of its use of geometry. Without ever reading the proof, she had condemned Wiles’ work. Can a proof be considered “correct” if not everyone understands it? What is the moral concept of an “accepted proof”?

- **Should calculators be used in the classroom, and should computers be used in research?** In 1976, Kenneth Appel and Wolfgang Haken gave a proof of the Four Color Theorem that required a computer to check thousands of cases. In 1994, Thomas Nicely discovered that certain Pentium processors were returning false answers via a command that was embarrassingly simple. In 2000, Thomas Hales presented a proof of Kepler’s Conjecture – but caused years worth of controversy because the result depended on computer data which no one could independently verify. Can computers be trusted to give correct results? Should computers be trusted to give correct results?

- **What are the moral obligations to conducting research in the mathematical sciences?** After his publication in 1859 entitled “On the Origin of Species by Means of Natural Selection,” Charles Darwin said of his work going counter to the Church of England: “Every new body of discovery is mathematical in form, because there is no other guidance we can have.” In 1967, J. Robert Oppenheimer said of his creation of the atomic bomb which killed millions yet ended a tedious war: “Now, I am become Death, the destroyer of worlds.” Are the ends found through symbolic manipulation justified by mathematical means? Is the act of performing research in the mathematical sciences really an innocuous pastime?

- **Why do some people choose to not accept prestigious awards?** In 1966, Alexander Grothendieck was awarded the Fields Medal for his contributions to algebraic geometry. In 1988, he was awarded the Crafoord Prize – but this time he declined stating ethical concerns. In 2002, Grigori Perelman presented a proof of the Poincaré conjecture. In 2006, he was awarded the Fields Medal, yet he declined stating: “I’m not interested in money or fame. I don’t want to be on display like an animal in a zoo. I’m not a hero of mathematics. I’m not even that successful, that is why I don’t want to have everybody looking at me.” In 2010 he was awarded the Millennium Prize – worth $1 million – which he declined again. Should Grothendieck or Perelman have accepted either prize? Perelman said he’s not “that successful.” What does it mean to be “successful” in mathematics?

- **Is diversity necessary in mathematics?** In 2005 at a Conference on Diversifying the Science and Engineering Workforce, Larry Summers made controversial remarks regarding the lack of women in tenured positions in science at top universities and research institutions. He hypothesized (1) that women with children are less willing or unable to work 80 hours per week in tenure track jobs and (2) that women are subject to both discrimination and different socialization. He argued that discrimination was economically unlikely because it would put institutions at a disadvantage compared to institutions that did not discriminate. Were these comments fair? Should women be encouraged to pursue careers in the mathematical sciences? Will mathematical theorems be any different with the inclusion of more women?