

The Joy of Numbers: Stalking the Big Primes

Dr. Susan Cooper – Fall 2009

Course Information Sheet

Course Description: You will experience the beauty and power of mathematics by exploring the properties of the integers and some of their modern applications. Number Theory, the branch of mathematics which focuses on the integers, is one of the oldest and most beautiful areas of mathematics, as well as one of the hottest areas of current research and applications. A central theme of the course will be the search for big primes, a problem as old as ancient Greece, and as new as today's newspaper. Part of our fascination with the integers is that they are the simplest of all mathematical objects, known to virtually every culture in recorded history, but problems involving them can be extremely challenging.

You will construct much of the content of the course, with questions from the instructor to stimulate your thinking. By considering concrete examples and looking for common threads or patterns, you will make conjectures (guesses based on good examples and data) and then try to verify or disprove them. You will gain facility and become confident that you can *do* mathematics and you will experience the joy of discovering hidden patterns and mathematical truths. You will gain an appreciation of the achievements of some of the great masters of the subject and you will see how much of our modern electronic world depends on Number Theoretic ideas.

As we investigate those most basic of mathematical objects, the integers, much of our emphasis will be on their building blocks, the primes. Our goal will be to discover the key facts about the integers and especially the primes that are needed for many of the modern applications of Number Theory. As we establish these key facts, we shall see how they are used in everything from card shuffling to shopping on the Internet.

ACE: Math 189H is pending approval for ACE Outcome 3. You will apply mathematical reasoning and computations to draw conclusions, solve problems, and learn to check to see if your answer is reasonable. Your instructor will provide examples, you will discuss them in class, and you will practice with numerous homework problems. The exams will test how well you've mastered the material.

Instructor: Dr. Susan Cooper

Office: Avery Hall, Room 338 *Email:* scooper4@math.unl.edu *Phone:* 402-472-7253

Office Hours: Wednesdays 11:00 a.m. - 12:00 p.m., Thursdays 1:00 p.m. - 2:00 p.m.,
or by appointment

Correspondence: The most reliable way to reach me is via email.

Class Times and Location: TR 9:30 a.m. – 10:45 a.m., Avery Hall – Room 13B

Course Web Page: <http://www.math.unl.edu/~scooper4/math189H.html>

We will also be using *Blackboard* which can be found at <http://my.unl.edu>.

Text: There will be no text. At the beginning of each class, I will distribute notes summarizing the discussion of the previous class. You will need to have a good notebook in which to record your work and keep these notes. I recommend buying a 3-ring binder.

Homework: Daily homework problems will be assigned and you will be expected to have prepared them for the next class. They are not to be written up to be handed in, but you are expected to be prepared to present your solution in class when called upon. Collaboration is both allowed and strongly encouraged on the daily homework problems. One of the best ways to learn is to explain what you are doing to someone else. The most important part of this course is the homework problems. Mathematics can be learned only by *doing* mathematics, and to succeed in this course, you must do the homework on a regular basis. Reread the previous two sentences. The message there cannot be overemphasized!

Participation: Each day I will randomly call upon several of you to present to the class your attempts at solutions to the homework problems assigned the previous class period. You are expected to be ready. Class participation will influence your final grade, as described in the section “Grading”.

Questions: There are no dumb questions. If you don’t understand something that I or one of your classmates is saying, stop us and ask for another explanation. If you have a question, there are surely others with the same question who may initially be too shy to ask. So speak up! You will be doing a service for your more reticent classmates.

Good Manners: In doing mathematics, or almost anything worth doing in life, one is going to make many errors and false starts while becoming more proficient. Think, for example, of learning to play a musical instrument or learning an athletic skill. We want to establish a classroom atmosphere where the inevitable false starts and mistakes become an opportunity to learn and to get better – not an opportunity for embarrassment. Thus, please be constructive and polite in questioning your colleagues in class.

Tests: There will be no in-class tests. There will be six take-home tests. Three of these will be *collaborative*; on these, collaboration with other students is both allowed and encouraged. The other three will be *solo*; on these, you work alone and no collaboration of any kind is allowed. The scheduled dates for the take-home tests are:

<u>Assigned</u>	<u>Due</u>	<u>Type</u>
Thursday, September 3	Thursday, September 10	Collaborative
Thursday, September 17	Thursday, September 24	Solo
Thursday, October 1	Thursday, October 8	Collaborative
Thursday, October 22	Thursday, October 29	Solo
Thursday, November 5	Thursday, November 12	Collaborative
Thursday, November 19	Thursday, December 3	Solo

Throughout this course and especially on the tests, I am more interested in seeing what you can do when given the time to reflect and think creatively, rather than having you repeat back information. Thus you may find some of the test problems somewhat challenging and frustrating at first. Don’t be discouraged. I want you to expand your thinking and to become more creative, to work like a scientist or mathematician in exploring the unknown. I don’t expect you to be able to do all the problems perfectly.

Final Exam: The final exam period for this course is Wednesday, December 16 from 10:00 a.m. to noon. There is no final examination for this course. However, this time period may be utilized for presentations described in the section “Class Project”.

Class Project: Each student will be required to participate in a group project (2-3 students per group). These projects will have both a written and an oral component. The last four or so class periods and the final exam period (if necessary) will be reserved for oral presentations, and the written component is to be submitted the day of the oral presentation. These projects can be based on interesting problems or applications that were considered in class, but which were not resolved, or they can be chosen from a list of topics that I will distribute in early October, or they can be on almost any topic (related to the course material) which has captured your interest. All topics must be approved in advance by me and all projects must be completed by the assigned presentation date. All participants in a group project will get the same grade on the project, so it is important that each person in the group participate fully and equally. Attendance during the project presentations is *mandatory* for all members of the class. Each absence during the presentation period will reduce your course grade by 1/3 letter.

Extensions: There will be *no* extensions. All work is to be submitted on the day it is due. Late work (regardless of reason) will be severely penalized. You know now when everything in this class will be due. Plan ahead.

Grading: Final grades will be determined as follows:

- class participation – 20%
- take-home tests – 60%
- project – 20%

Mathematics Department Grading Policy: Students who believe their academic evaluation has been prejudiced or capricious have recourse for appeals to (in order) the instructor, the department chair, the departmental appeals committee, and the college appeals committee.

Honor Code: I will be very explicit about when you may collaborate and when I expect the work you submit to be yours alone. I will assume that you will adhere to the UNL Policy on Academic Honesty.

Students with Disabilities: Students with disabilities are encouraged to contact me for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska - Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 402-472-3787 voice or TTY.