The Joy of Numbers: Stalking the Big Primes
Professor Mark Brittenham – Fall 2011
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 Outcome 3: This course satisfies 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 and project will test how well youve mastered the material.

Lecture: TuTh 12:30-1:45 Avery Hall (AvH) 13B

Instructor: Mark Brittenham

Office: Avery 317.

Office Hours: (tentatively) Mo 1:00-2:00, Tu 11:00-12:00, W 11:00 - 12:00, and whenever you can find me in my office and I'm not horrendously busy. You are also quite welcome to make an appointment for any other time; this is easiest to arrange just before or after class, or via email.

Phone: 472–7222. (But read the next item.)

Email: `mbrittenham2@math.unl.edu` This is the most reliable way to reach me, and is, in particular, much better than phone messages.

Web Page: `http://www.math.unl.edu/∼mbrittenham2`

WWW pages for this class: http://www.math.unl.edu/∼mbrittenham2/classwk/189f11/

(There you will find copies of every handout from class, problem sets, class notes, and other items of interest.)

Class lockbox: http://www.math.unl.edu/∼mbrittenham2/classwk/189f11/lockbox/

(There you will find things (articles, solutions) that shouldn't be given public access. The username(s) and password(s) will be provided shortly after you read this.)

Text: There will be no text. At the beginning of each class, your instructor 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. A three-ring binder is recommended to keep all of these materials together and in order.

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 try 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. This cannot be overemphasized; to succeed in this course, you must do the homework on a regular basis!

Participation: Each class will begin with some combination of several of you volunteering/being randomly called upon to present to the class your attempts at solutions to the homework problems assigned during the previous class period. You are expected to be ready. Class participation will influence your final grade, as described in the section on Grading below.

Questions: There are no dumb questions. If you don't understand something that your instructor 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 hesitant to ask. So speak up! You will be doing a service for your classmates, as well as yourself!

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*, (i.e., collaboration with other students is allowed and encouraged) and three will be *solo*, which means you work alone and no collaboration of any kind is allowed. The dates for the take-home tests are currently scheduled for:

Given Out	Due	Type
September 1	September 8	Collaborative
September 15	September 22	Solo
September 29	October 6	Collaborative
October 20	October 27	Solo
November 3	November 10	Collaborative
November 17	December 1	Solo

This schedule may change as circumstances warrant. Throughout this course and especially on the tests, we will be more interested is 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. Part of the goal of this course is to help you to expand your thinking and to become more creative, to work like a scientist or mathematician in exploring the unknown. You will not (neccesarily!) be expected to be able to do all of the problems.

Final Exam: There is no final exam for this course.

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 three classes or so and the final exam period (if necessary) will be reserved for oral presentations, and the written part is to be turned in the day the oral part is presented. 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 will be distributed 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 that work, 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.

Extensions: There will be **NO** extensions. All work is due on the day it is due. Late work (regardless of reason) will be severely penalized. You will know well in advance 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%

Honor Code: It will be very explicitly stated when you may collaborate on some part of your work and when I expect the work you hand in to be yours alone. You are expected to adhere to the UNL Policy on Academic Honesty.

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

Some important academic dates

Aug. 22 (Mon.) First day of classes.
Sept. 2 (Fri.) Last day to withdraw from a course without a **'W'**.
Sept. 5 (Mon.) Labor Day - no classes (not that it matters for this class).
Oct. 14 (Fri.) Last day to change to or from P/NP.
Oct. 17-18 (Mon.-Tue.) Fall break - no classes.
Nov. 11 (Fri.) Last day to withdraw from a course.
Nov. 23 (Wed.) Student holiday - no classes.
Nov. 24-27 (Thu.-Sun.) Thanksgiving Vacation - no classes.
Dec. 10 (Sat.) Last day of classes.
Dec. 12-16 (Mon.-Fri.) Final exam week
Dec. 17 (Sat.) Fall semester undergraduate commencement.