

**Humboldt State University
Mathematics Department
Math 340: Number Theory**

Fall Semester, 2016

Instructor:	Dr. Peter Goetz
Office Location:	BSS 358
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Office Hours:	Monday: 11:00 - 12:00 Tuesday: 2:00 - 3:00 Wednesday: 9:00 - 10:00 Thursday: 11:00 - 12:00 Friday: 9:00 - 10:00
Class Days/Time:	MWF from 8:00 - 8:50 AM
Classroom:	BSS 302
Prerequisites:	Math 240, Math 241, CS 111, or instructor approval

Course Description

Divisibility, congruence, quadratic reciprocity, arithmetic functions, Diophantine equations, cryptography, introduction to algebraic number theory. The format of the course is lecture-discussion. A minimum grade of C- is required for this course to count toward the mathematics major.

Course Goals and Student Learning Outcomes

Course learning outcomes:

- 1) Know the basic properties of integers such as divisibility, prime and congruence.
- 2) Apply the Euclidean algorithm.
- 3) Solve linear Diophantine equations and linear congruences.
- 4) Solve systems of linear congruences by means of the Chinese remainder theorem.
- 5) Write and present a correct mathematical proof using standard notation and presentation conventions.

- 6) Constructively criticize mathematical arguments.

Program learning outcomes:

It is expected that each mathematics graduate will be able to:

- 1) Reason mathematically and statistically.
- 2) Solve complex problems using mathematics and statistics.
- 3) Communicate mathematical and statistical ideas.
- 4) Evaluate mathematical and statistical work.
- 5) Demonstrate mathematical knowledge commensurate with national norms.

HSU learning outcomes:

HSU graduates will have demonstrated:

- 1) Effective communication through written and oral modes.
- 2) Competence in a major area of study.

Required Texts/Course Website

Textbook:

Elementary Number Theory, Second Edition, Charles Vanden Eynden

ISBN-13: 9781577664451

Course Website:

Course announcements and links to course handouts, homework assignments, solutions to exams and other material will be posted at

<http://users.humboldt.edu/pgoetz/math340.html>

Course Expectations

I expect you to participate in the course by attending all of the lectures, to arrive to class on time and prepared to learn, and to turn in all homework assignments by the due date. I expect you to read the required section in the textbook before each lecture. I expect you to be polite and respectful of your fellow class members and myself. Please refrain from cell phone use in class except for emergencies and have your phone on silent during class. In general, it is expected that students spend at least two hours studying outside of class for each class meeting. Plan on spending at least 6 hours per week studying Number Theory. (If you really want to excel in the course, you might need to study 12 or more hours per week.)

You may expect that I: come to class prepared to teach, give clear lectures, assign homework problems that are relevant to the course, and prepare exam questions that accurately measure your progress in the course. Additionally, I am available outside of class for consultation in office hours. I hope to share with you my passion for mathematics!

Assignments and Grading Policy

Homework:

Homework will be collected in class usually on Wednesdays and sometimes on Fridays. The due dates of the homework assignments are given in the daily schedule, which appears below. There is a separate document that lists the homework problems to be collected and graded. You need to work hard on the homework. Most people find it difficult to learn mathematics without working lots of problems.

I encourage you to work together and to discuss the homework with your classmates, but you must turn in your own work, written in your own words. Plagiarizing work from the internet, or copying from anyone will absolutely not be tolerated. If you are caught, or if I suspect that you have copied work that is not your own, you will be given a score of zero on the assignment, and it will be necessary that you meet with me in my office. For more detailed steps that will be taken, please read:

<http://www2.humboldt.edu/studentrights/academic-honesty>

Absolutely no late homework will be accepted.

Homework is worth 25% of your overall course grade.

Exams:

We will have two inter-semester exams. The dates of these exams are given below. Mark your calendars and plan accordingly as **no makeup exams** will be given.

Exam I: Monday, October 3, 2016

Exam II: Monday, November 14, 2016

Each exam is worth 25% of your overall course grade.

Final Exam:

Day-Date-Time-Place: Friday; December 16, 2016; 8:00 – 9:50 AM; BSS 302

The final exam is worth 25% of your overall course grade.

Grading Components:

Homework	25%
Exam I	25%
Exam II	25%
Final Exam	25%

Grading Scale:

All numbers listed below are in percentages. I will round your overall weighted course percentage to the nearest whole percent. Participation in class may work in your favor for borderline cases.

A: 92-100; A-: 90-91; B+: 88-89; B: 82-87; B-: 80-81; C+: 78-79; C: 68-77; C-: 64-67; D: 55-63;

F: 0-54

Daily Schedule

During class time we will have a mix of lecture and discussion. On the daily schedule below, you will see a column titled “Section”. Those are the sections in our textbook I will expect you to have read in preparation for that day’s lecture. Reading the sections before lectures will enable you to gain more information from the lectures. It is very important that you keep up with the readings and attend each lecture prepared to discuss the material in the readings.

Date	Topics	Section	Assignment Due
8/22	Divisibility	1.1, 1.2	
8/24	Division Algorithm	1.2	
8/26	GCD and LCM	1.1	
8/29	Euclidean Algorithm	1.3	
8/31	Euclidean Algorithm	1.3	Assignment 1
9/2	Linear Diophantine Equations	1.4	
9/5	Labor Day, no class		
9/7	Congruence	1.5	
9/9	Congruence	1.5	Assignment 2
9/12	Induction	1.6	
9/14	Prime Factorization	2.1	Assignment 3
9/16	Fundamental Theorem of Arithmetic	2.2	
9/19	Consequences of Unique Factorization	2.3	
9/21	Prime Power Factorizations	2.4	Assignment 4
9/23	Divisibility Tests	2.4	

9/26	The Set of Primes is Infinite	2.5	
9/28	The Number of Divisors Function	2.6	Assignment 5
9/30	The Sum of Divisors Function	3.1	
10/3	Exam 1		
10/5	Multiplicative Functions	3.2	
10/7	Multiplicative Functions	3.2	Assignment 6
10/10	Perfect Numbers	3.3	
10/12	Mersenne Numbers	3.4	Assignment 7
10/14	Fermat Numbers	3.4	
10/17	Euler's Phi Function	3.5	
10/19	The Möbius Function	3.6	Assignment 8
10/21	Möbius Inversion Formula	3.6	
10/24	Linear Congruences	4.1	
10/26	The Chinese Remainder Theorem	4.2	Assignment 9
10/28	Reduced Residue Systems	4.2	
10/31	Euler's Theorem	4.3	
11/2	Fermat's Theorem	4.3	Assignment 10
11/4	Wilson's Theorem	4.3	
11/7	Primality Testing	4.4	
11/9	Cryptography	4.5	
11/11	Veteran's Day, no class		Assignment 11
11/14	Exam II	4.5	
11/16	Cryptography	4.5	
11/18	Polynomial Congruences mod p	5.1	
11/21-11/25	Thanksgiving Holiday		
11/28	Hensel's Lemma	5.2	
11/30	Quadratic Residues	5.3	

12/2	Quadratic Residues	5.3	Assignment 12
12/5	Quadratic Reciprocity	5.4	
12/7	Quadratic Reciprocity	5.4	
12/9	Pythagorean Triples	7.1	Assignment 13
12/16	Final Exam		

University Policies

The following link provides HSU policies on: academic honesty, attendance and disruptive behavior, complaints against faculty, staff, or administrators, student code of conduct, and animals in classrooms or laboratories. It also has procedures for dropping or adding a class, **please note that September 5, 2016 is the deadline to Add or Drop courses without a serious and compelling reason for the Fall 2016 semester**, and campus emergencies. Finally there is information regarding counseling and psychological services, the student disabilities resource center, financial aid, and academic and career advising.

<http://www2.humboldt.edu/academicprograms/syllabus-addendum-campus-resources-policies>