Course Syllabus
Elementary Number Theory

Course Information

MATH 3323.001 Elementary Number Theory, Fall 2016, course number 85292
Class meets Tuesday & Thursday: 10:00am–11:15am in FO 3.222.

Professor Contact Information

Dr. Paul Stanford, 972-883-4143, paul.stanford@utdallas.edu, FA 2.412
Hours: MW 1:15pm–2:00pm, TR 11:45am–12:30pm.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

A grade of at least C- in either Math 2414 or in Math 2418 or in Math 2419 is required.

Students are expected to have achieved a reasonable level of mathematical maturity, including exposure to exacting disciplines of thought. Experience with some proof techniques will be advantageous.

Course Description

Topics will be drawn from but not restricted to the following:

The integers and natural numbers, divisibility, congruence arithmetic, the Euclidean algorithm, greatest common divisors, Bézout coefficients, the fundamental theorem of arithmetic (unique factorization), solving linear congruences, the Chinese remainder theorem, Euler's totient function $\varphi(n)$, public key encryption algorithms, arithmetic functions, quadratic reciprocity, irrationality of numbers like e and $\sqrt{2}$, the Möbius $\mu(n)$ function, arithmetic properties of Fibonacci numbers, Pell's equation, continued fractions, prime numbers, Fermat primes, Mersenne primes, prime number theorem, Bertrand's postulate, Goldbach conjecture, Riemann's hypothesis, partitions, Pascal's triangle, sums of squares, representations, Pythagorean triples, Lagrange's four square theorem, rational approximations, linear diophantine equations, primality testing, factorization techniques, primitive roots, order.

Student Learning Objectives/Outcomes

This course will explore many topics in elementary number theory. This will include elements of numeric and algorithmic work as well as elementary proofs of various sorts. Students will obtain an appreciation and facility in a wide range of elementary number theory concepts and algorithms, and will use that as a foundation to develop skills in conjecture formation, finding counterexamples, and providing proofs of many results using different techniques such as induction, contradiction, proof by cases, and direct implication. Algorithms will be developed for various aspects, some by the students.

Examinations

The midterm exam will be held from Thursday October 20th in the Testing Center (subject to change). You must register to take this exam at http://registerblast.com/utdallas/exam by September 8th at the latest. The comprehensive final exam will be in December; details to be announced when available.

Required Textbooks and Materials

Elementary Number Theory & its Applications
by Kenneth H. Rosen
Sixth Edition
Publisher: Addison Wesley

ISBN-13: 978-0-321-50031-1
ISBN-10: 0-321-50031-8

Suggested Course Materials

In addition to the textbook here are a few book that may be of interest as additional or background reading. Not all of them, of course, but you might enjoy reading one or maybe two in addition to the textbook depending on your particular likes and dislikes, or particular passions and applications. For these, a cheap used copy would be recommended as the edition is not important. Again absolutely optional and at your own discretion and enjoyment:

Of course, the main textbook should be on your list, and will be fine if that's the only one you use. Sometimes having a different perspective can be enlightening, as can seeing the slight variations in exact definitions, especially in edge cases, especially anything dealing with the number zero. In fact, some of the definitions we will use in class will be slightly different from any of these books (although at least one will agree with each part!). The guiding principle in such matters will be to avoid unnecessary restrictions.

Elementary Number Theory: Primes, Congruences, and Secrets
A Computational Approach
by William Stein
Springer

Delightful little book, and an enjoyable read.

Elementary Number Theory in Nine Chapters
Second Edition
by James J. Tattersall
Cambridge University Press

A great read.

Number Theory with computer applications
by Ramanujachary Kumanduri & Christina Romero
Prentice Hall

Very good in terms of computer applications; full with computer challenges.

Elementary Number Theory
Seventh Edition
by David M. Burton
McGraw Hill

Basically good, although the language is a little archaic and annoying.

Beginning Number Theory
Second edition
by Neville Robbins
Jones and Bartlett

A bit pedestrian, but if this is a whole new world to you this may be helpful to get you started.

1001 Problems in Classical Number Theory
Jean-Marie De Koninck & Armel Mercier
American Mathematical Society

The title says it all.

Assignments & Academic Calendar
(Topics, Reading Assignments, Due Dates, Exam Dates)

There will be three projects assigned during the semester and one midterm examination. There will also be a comprehensive final examination. Shorter take-home quizzes will be assigned on a regular basis.

Grading Policy
(including percentages for assignments, grade scale, etc.)

Each take-home quiz is worth 20 points.
Projects are rated at 100 points apiece.
The midterm examination is worth 100 points.
The comprehensive final examination is worth 150 points
The letter conversion map will take an overall 97% or better as an A+, then 93% or better as an A, then 90% or better as an A-. The scale for B+, B, B- covers the 80s, and so on.

Course & Instructor Policies
(make-up exams, extra credit, late work, special assignments, class attendance, classroom citizenship, etc.)

All projects and take-home quizzes must be your own work: group work is not permitted on these.

Attendance and participation in class discussion is expected, as well as timely submission of homework and projects, and collection of graded work. All work must be clear and legible. Students are also expected to show respect for each other during the class and examination periods. Cell phones and other distracting devices should be turned off during those times.

Makeup projects and examinations are only given in extraordinary situations and only with adequate and timely documentation.

UT Dallas Syllabus Policies and Procedures

> The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.
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> Please go to http://go.utdallas.edu/syllabus-policies for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.