Math 311w Section 005, Autumn 2018
Concepts of Discrete Mathematics

Where and When: Sackett 107, MWF, 11:15 - 12:05
Teacher: Timothy Reluga, Associate Professor of Mathematics
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Office hours: Wednesday 2 - 3 pm, walk-ins, and appointment arranged by email
Course Web page: http://www.math.psu.edu/treluga/311w

Course Description

This course introduces students to the use of mathematics as a formal language. Using a theorem-proof framework much like that used in Euclid's geometry textbook 2 millennium ago, we will study elementary number theory from ancient to modern results including modular arithmetic, set theory, formal logic, groups, and other discrete-math topics. Applications include RSA encryption and error-correcting codes. **Prerequisites**: Students must be comfortable with algebra, rational numbers, and linear systems.

Textbook

Numbers, Groups, and Codes , 2nd edition, by J. F. Humphreys and M. Y. Prest. The course will cover chapters 1-5, plus some lecture material not in the textbook. The book is available online through our library.

Grading

The final grade will be assigned by a function $G(x)$ that takes scores of x points out of 460 points.

$$G(x) = \begin{cases} \text{A if } 429 \le x \le 460 \text{ pts,} & \text{A- if } 414 \le x < 429 \text{ pts,} \\ \text{B+ if } 398 \le x < 414 \text{ pts,} & \text{B if } 383 \le x < 398 \text{ pts,} \\ \text{B- if } 368 \le x < 383 \text{ pts,} & \text{C+ if } 352 \le x < 368 \text{ pts,} \\ \text{C if } 322 \le x < 352 \text{ pts,} & \text{D if } 276 \le x < 322 \text{ pts,} \\ \text{F if } 0 \le x < 276 \text{ pts,} \end{cases}$$

Grades will be based on two term exams (100 points each), a final exam (150 points), 7 in-class quizzes (10 points each), and 3 short-essay writing assignments (20 points each). The lowest two quiz grades will be dropped. The first exam will be October 1st in class, the second will be November 2nd in class. Quizzes will be given on Fridays at the beginning of class. There will be no make-up quizzes. The time and location of the final exam is not yet determined.

Learning goals

After this course, you will recognize basic discrete-math concepts and provide clear and precise arguments for why the presented results are true and the algorithms studied work. This includes being able to read and write a mathematical proof.

To assist you in reaching these goals, I will lecture in class on the course material. You are expected to read the textbook as well on your own time. Homework problems will also be suggested. You should do these problems and check your own answers. I will happily answer questions about homework problems in class. Testing, in the form of quizzes, essays, and exams will be given to encourage you to keep up with the material and to assess your progress through the semester.

Course Outline

Midterm Exam 1 : Number theory, modular arithmetic, RSA Encryption (Chapter 1)

Midterm Exam 2 : Logic, sets, relations, functions, digraphs (Chapters 2 and 3)

Final : Exams 1 and 2 material + group theory and codes (Chapters 4 and 5)

Homework

Reading and homework assignments will be posted weekly on the class web page. Homework problems will be assigned online for practice, but will *not* be graded.

Academic integrity

All Penn State Policies regarding ethics and honorable behavior apply to this course.
In this course we will be using Turnitin to confirm that you have used sources accurately in your papers. You will retain all copyright use of this paper . If you have any questions about how to cite your sources, please review the materials available on the following pages:

- University Libraries Plagiarism and You

- iStudy module on Academic Integrity, Plagiarism and Copyright

- Plagiarism Tutorial for Students page

Students are responsible for ensuring that their work is consistent with Penn State's expectations about academic integrity. Additional information about the Turnitin plagiarism prevention tool is available on the Turnitin site and on the Student Paper Upload into Turnitin page.

Disability accommodations

In order to receive reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelines `http://equity.psu.edu/sdr/guidelines`. If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations. For further information, please visit Student Disability Resources website `http://equity.psu.edu/sdr/`.

Counseling services

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional well being. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

- Counseling and Psychological Services at University Park (CAPS) (`http://studentaffairs.psu.edu/counseling/`): 814-863-0395

- Counseling and Psychological Services at Commonwealth Campuses (`http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/`)

- Penn State Crisis Line (24 hours/7 days/week): 877-229-6400

- Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational Equity

Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined at `http://equity.psu.edu/reportbias/`

Course goals

- Read a proof

- Learn basic proof techniques

- Develop mathematical reasoning

- Learn elementary number theory and discrete mathematics

- Understand a proof

- Develop technical communications skills

- Develop math communications skills

- Express a satisfactory proof in writing

Course Objectives

The objectives of this course will be to learn the definitions, theory, and algorithms associated with each of the following, and to be able to communicate these to others in writing.

- Integer division

- Greatest common divisors

- Mathematical induction

- Prime numbers

- Unique Factorisation of integers

- Congruence classes

- Linear congruence equations

- Euler's theorem

- RSA and public key encryption

- Elementary set theory

- Theory of functions

- Theory of relations

- Formal logic

- Propositional logic

- Logical quantifiers

- Common proof strategies

- Permutations

- Groups

- Cosets and Lagrange's Theorem

- Groups of small order

- Write an essay on Euclid's number theory

- Write an essay on relations

- Write an essay on one of a suggested range of topics