

Math 321 — Elementary Number Theory

Fall 2023

Instructor Information

Instructor: Ben Salisbury, Professor
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Email: salis1bt@cmich.edu
Office Hours: By appointment
Office Hours Location: Pearce 212

Course Information

Meeting Times: TR 9:30-10:45am in Pearce 223

Course Text: James S. Kraft and Lawrence C. Washington, *Elementary Number Theory*, Second Edition, Chapman and Hall/CRC, 2015.

Objectives: We will cover a good chunk of the course text; divisibility, Euclidean algorithm, prime factorization, congruences, elementary Diophantine equations, and applications to cryptography. Specifically, by the end of this course, you will be able to:

- (1) use standard elementary arithmetical algorithms to compute greatest common divisors, continued fractions, prime factorizations, primitive roots, etc.;
- (2) solve standard types of Diophantine equations, including linear equations and Pell's equation;
- (3) explain the contents of basic theorems of number theory such as Fermat's and Wilson's theorems, and apply them in concrete situations;
- (4) explain the application of number theory to standard cryptosystems, such as RSA, ElGamal and DSA.

Chapters to be covered: (Hopefully...)

- Appendix A: *Supplementary Topics*
- Chapter 2: *Divisibility*
- Chapter 4: *Unique Factorization*
- Ch. 5: *Applications of Unique Factorization*
- Chapter 3: *Linear Diophantine Equations*
- Chapter 6: *Congruences*
- Chapter 8: *Fermat, Euler, and Wilson*
- Chapter 17: *Continued Fractions*
- Chapter 7: *Classical Cryptosystems*
- Chapter 9: *RSA*
- Chapter 11: *Order and Primitive Roots*
- Ch. 12: *More Cryptographic Applications*

Important note: This syllabus is subject to change throughout the semester. Any changes, however, to the syllabus will be accompanied by a message to the class about the change.

Grading Breakdown

Homework. Homework will be assigned every Thursday on Blackboard starting with the first week of class, and it will be collected at the start of class on the following Thursday. This homework is your primary practice for exam questions. Should you have any difficulty with the homework assignments, you should seek help from fellow classmates and/or from the instructor (during class, during office hours, via email, any way possible!). [Asking Dr. Google is strongly frowned upon — stealing from Dr. Google is **illegal**.] Struggling through this material is part of the learning process and is an expected side-effect of this class. You are encouraged to experience this struggle collectively and support your fellow students.

Exams. There will be three midterm exams (see below) and a final exam on Tuesday, December 12, 2023, 10:00-11:50am. Absolutely no make-up exams will be given without prior permission of the instructor. Validity of excuses is determined by the instructor. If an emergency happens on the day of an exam, a notice within 24 hours of the start of the scheduled exam is required in order for make up of the missed exam to be considered. All decisions about makeup exams and exceptions to the above policy are at the discretion of the instructor. No calculators are allowed in midterms and final exams.

Homework	Weekly	40%
Exam 1	Thursday, September 28, 2023 in class	20%
Exam 2	Thursday, November 2, 2023, in class	20%
Final Exam	Tuesday, December 12, 2023, 10am-11:50am	20%

Technical Help

Blackboard will be incorporated to a large extent in this course. If you have a technical issue related to Blackboard, please contact the OIT Help Desk at (989) 774-3662, <http://helpdesk.cmich.edu>, or helpdesk@cmich.edu.

Communication Policy

The following communication policy outlines behaviors that are and are not appropriate in all methods of communication in the online class environment. Any questions about this policy should be addressed to the instructor.

When communicating online, DO:

- ask questions about class material;
- ask questions about assignments;
- respond to other students' postings in a way that will provoke conversation;
- reply to postings when you are addressed and generally display behaviors that encourage conversation.

When communicating online, DO NOT:

- use offensive or abusive language;
- mock or make derogatory comments about anyone else's posting;
- display inappropriate pictures or graphics;
- leave a posting that is addressed to you unanswered;
- hesitate to post a question that you have – remember, many students may have the same question but are too afraid to ask so you are benefiting them as well by posting it.

Classroom Civility/Etiquette: Each student is encouraged to help create an environment that promotes learning, dignity, and mutual respect for everyone. This applies to all aspects of the class, particularly communication and interactions. Students who use offensive language, are verbally abusive, display deference or disrespect to others, post inappropriate or offensive pictures or comments, or exhibit other inappropriate behaviors in the online class environment may be subjected to disciplinary action under the [Code of Students Rights, Responsibilities, and Disciplinary Procedures](#).

Additional Notes

- **Academic Integrity:** To promote integrity and deter dishonest academic work, it may be useful to consider including a statement of expectations and consequences related to academic misconduct in your course syllabus. Visit the Office of Student Conduct web page for more details. For more information, see the [Academic Integrity Policy](#).
- **Attendance:** No attendance will be taken in class *but* you are responsible for knowing the material, assignments, and anything else presented and announced in class. While attendance in class is (theoretically) optional, be advised that your grade will most assuredly suffer from repeated absence from the lectures.
- **Accommodations:** Central Michigan University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please register with the Office of Student Disability Services (Park Library, Room 120, 989-774-3018) and contact me with a letter of accommodations as soon as possible. Retroactive requests for accommodations will not be honored. For more information, see <https://www.cmich.edu/ess/studentaffairs/SDS/Pages/default.aspx>.
- **COVID-19 Information and Resources:** Up-to-date COVID-19 Information and Resources for the CMU community can be found at <https://www.cmich.edu/covid19/Pages/default.aspx>.
- **Financial Wellness:** I understand that the majority of college students experience some type of financial insecurity at some point—from lack of steady income to housing insecurity to confusion about debt or financial aid—and that these stresses can impact their lives on campus. Students do not need to navigate these challenges on their own. The [Financial Wellness Collaborative](#), located in Bovee UC 116A, offers 1:1 Peer Coaching for students to talk about scholarships, budgeting, credit and debt, paying back school loans, and many other financial issues. They are a first-stop resource for students who are feeling overwhelmed or confused about their financial situations.
- **Food Insecurity:** One in three CMU students report being hungry without immediate means to satisfy that hunger. I understand being hungry makes learning and succeeding in college difficult. CMU has compiled a [list of community resources](#) available to address concerns related to food insecurity and other basic needs.

- **Harassment and Discrimination:** Central Michigan University, an AA/EO institution, strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon age, color, disability, ethnicity, familial status, gender, gender expression, gender identity, genetic information, height, marital status, national origin, political persuasion, pregnancy, childbirth or related medical conditions, race, religion, sex, sex-based stereotypes, sexual orientation, veteran status, or weight. Any student who has concerns about such behavior should contact their instructor or the Office of Civil Rights and Institutional Equity at 989-774-3253 or ocrie@cmich.edu.
- **Inclusion:** CMU prides itself on being “an inclusive community of scholars” and adheres to the core values of “integrity, respect, compassion, inclusiveness, social responsibility, excellence and innovation.” As such, I intend for this learning environment to be a place where you feel respected and valued, and have your identities supported and affirmed (e.g., race, class, gender, gender identity, national origin). If you experience marginalization or discrimination in this class, please let me know so we can make our learning environment more inclusive and just. I can help connect you to resources or make adjustments to better meet your needs.
- **International Students:** Welcome to CMU and this class! While you are probably already familiar with the [Office of Global Engagement](#), there are many other services on campus that you may find helpful. All CMU services are available to domestic and international students alike. There is free support for mathematic skills ([Math Assistance Center](#)), public speaking and presentations ([Presentation Skills Center](#)), and writing ([Writing Center](#)), as well as tutoring for specific classes you may want help with ([Academic Advising and Assistance](#)). As you approach graduation or begin looking for an internship, you may also want to visit the [Career Development Center](#).
- **LGBTQ Chosen Names and Personal Pronouns:** Everyone has the right to be addressed by the name and pronouns that correspond to their gender identity, including non-binary pronouns (e.g., they/them/theirs, ze/zir/zirs). Central Michigan University’s chosen name policy can be accessed here bit.ly/2td7yYC and the name change form can be accessed here: bit.ly/2sIYfiJ. Rosters do not list pronouns, so, while you are not obligated to do so, you may indicate the pronouns you use so that I do not make assumptions based on your name and/or appearance/self-presentation. Chosen names and pronouns are to be respected at all times in the classroom. Mistakes in addressing one another may happen, so I encourage an environment of openness to correction and learning. I will not, however, tolerate repeated comments that disrespect or antagonize students who have indicated pronouns or a chosen name. Chosen name and personal pronouns may evolve over time, so if at any point during the semester you would like to be addressed differently, please let me know.
- **LGBTQ Equality Statement:** I am firmly committed to diversity and equality in all areas of campus life. In this class, I will work to promote an anti-discriminatory environment where LGBTQ students feel safe and welcome. I recognize that discrimination can be direct or indirect and take place at both institutional and personal levels. I believe that such discrimination is unacceptable, and I am committed to providing equality of opportunity for all by eliminating any and all discrimination, harassment, bullying, or victimization. If you need additional support or access to resources, please reach out to Office of LGBTQ Services & Gender Equity Programs, Shannon Jolliff-Dettore, Director, at jollifsm@cmich.edu.
- **Library and Research Services:** As a CMU student, you have full access to the services and resources of the CMU Library. Reference librarians will help you find information on your re-

search topic and answer other questions related to the library. The library's Documents on Demand office will obtain copies of the books and journal articles for you. Check out the library's website for more information.

- Reference librarian libref@cmich.edu or (989) 774-3470
 - <http://libguides.cmich.edu/askalibrarianform>
 - Documents on Demand docreq@cmich.edu or (989) 774-3022
 - <https://illiad.cmich.edu/>
- **Make-ups:** Make-ups are not allowed. With the understanding that extenuating circumstances sometimes arise, make-ups may be considered at the Instructor's discretion and will be handled on a case-by-case basis provided that the student contacted the Instructor prior to the missed assignment. In the event that a make-up is allowed, the student should be prepared to provide documentation verifying their reason for missing the assignment, exam, etc. Please note technical difficulties do not constitute a valid excuse.
 - **Mental Health Matters:** It is important to take care of your emotional well-being. I recognize that students can experience mental health challenges that make learning difficult. If you find that life stresses such as increased anxiety, feeling down, strained relationships, suffering a loss, or dealing with a personal struggle are interfering with your academic or personal success, CMU is here to help. Please consider contacting the CMU Counseling Center at Foust 102 by calling 774-3381 for free, confidential counseling services. More information and other resources are available at www.counsel.cmich.edu. I am available to assist you in connecting with resources that might best meet your needs.
 - **Mutual Respect and Professionalism:** Students must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivities to others' diverse backgrounds. This includes showing courtesy and respect toward all students, regardless of differences. Students must demonstrate accountability in their actions, as well as a commitment to integrity. Examples of unprofessional behavior include but are not limited to plagiarism, inappropriate public behavior, cheating, and recurring issues with punctuality and attendance.
 - **Netiquette:** Discussion boards and chat rooms are the primary communication channels in online courses. Most of the time, those tools are text-based. Pay attention to the following when you are communicating with your instructor and/or peer students in online courses: Check before you post. Always check whether a similar question to yours has been posted and answered on the discussion board to avoid duplicated messages and responses. Use a descriptive subject line. When creating a new message or replying a message, use a descriptive subject line that reflects the content of your message. It can help readers catch the key concept even before reading your message. This makes the discussion more efficient. Use emotional symbols (: -), ; -), :- (, : ^ - (, :-p, etc.) to indicate the tone of voice. It is often hard to tell the emotion of a text-based message. Use emotional symbols to give your message a little social touch. :-) Do not edit or change the message content once someone has already responded to you. If you have something to add or change, simply add a follow-up message. People in this course may come from places around the world, so be respectful to other cultures and languages. Be careful with sarcasm. Respect others. Like all communication and discussion occasions, use your professionalism and talk to others with respect. Unprofessional messages will be removed.

- **Religious Accommodations:** If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request.
- **Sexual Misconduct Policy:** Under the Sexual Misconduct Policy, dating violence, domestic violence / intimate partner violence, sexual assault, sexual exploitation, sexual harassment, stalking and retaliation will not be tolerated and are expressly prohibited. CMU strives to eradicate sexual misconduct through primary prevention and on-going awareness programs, education, training, clear policies and serious consequences for acts of sexual misconduct. The Sexual Misconduct Policy applies to all CMU faculty, staff and students regardless of sex, gender, gender identity, gender expression or sexual orientation. Sexual misconduct and retaliation both on- and off-campus are strictly prohibited. CMU strives to offer resources and support to students experiencing concerns about sexual misconduct. Confidential resources and support centers, such as the Sexual Aggression Peer Advocates (989-774-2255) and the CMU Counseling Center (989-774-3381), provide confidential support for students. With the exception of these confidential resources and those named explicitly within the Sexual Misconduct Policy, all CMU staff and faculty are responsible employees and are required to report any information they know about possible sexual misconduct to the Office of Civil Rights and Institutional Equity (989-774-3253, Bovee University Center 306). This means that any incident you may divulge to a faculty member cannot be confidential. Reports to OCRIE are intended to provide options and resources to survivors.
- **Student Disability Services:** CMU provides students with disabilities reasonable accommodations to participate in educational programs, activities or services. Students with disabilities requiring accommodations to participate in class activities or meet course requirements should register for services through [Student Disability Services](#), 120 Park Library, 989-774-3018.