

Number Theory and Its Applications

Math 641 | 3 Credit Hours | Fall 2023: 8/21/23 - 12/15/23

Instructor: Dr. Misty Ostergaard

In-person Office Hours: TBA

Virtual (Zoom) Office Hours: By appointment or TBA.

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Phone: (812) 465-1264

Office Location: SC 3261

Zoom Office Hours Link:

<https://usi.zoom.us/j/92324557707>

Time Zone Note: All times listed in this syllabus are Central Time.

Course Description

In this course, students are expected to prove theorems in elementary number theory; apply number theoretic concepts to solve various types of problems; communicate (through both writing and speaking) about various topics in elementary number theory using appropriate notation and terminology. This course will cover various topics in number theory such as divisibility, modular arithmetic, arithmetic functions, continued fractions, and cryptology.

Prerequisites: 24 hours of mathematics courses including the Calculus sequence.

Students taking this course will be expected to know how to write standard direct and indirect proofs, including proofs by mathematical induction.

Course Learning Objectives

Upon successful completion of this course, students will be able to:

1. Prove theorems in elementary number theory.
2. Apply number theoretic concepts to solve various types of problems.
3. Communicate mathematical ideas with clarity, precision, and accepted notation.
4. Communicate orally about various topics in number theory using appropriate terminology.
5. Analyze other students' works and support your findings.

Program Learning Outcomes

1. Demonstrate knowledge of advanced mathematics in the areas of mathematics typically taught in grades 9-12; and
2. Apply mathematics processes in their own learning of advanced mathematics.

Communication Guidelines

- **Netiquette**

All class communications and interactions with other students and the professor should follow common social standards for respect and courtesy. Learn about the [USI Netiquette Guidelines for Online Students](#) so that you can get the most out of your class.

- **Communication Expectation**

The best way to contact me is via e-mail (m.ostergaard@usi.edu). I will do my best to respond to students' emails within 24 hours during the week and within 48 hours on weekends. I will also do my best to give feedback on your written homework assignments within a week of when they are due.

Blackboard Course Site Overview

When first entering our Blackboard Course Site, you should see the “Start Here” page. You should carefully look through each of the eight items on this page (including this syllabus) as soon as you can.

On the left-hand side of the course site, you should see pages for the course Syllabus and Calendar, course Announcements, my office hours, and the textbook we will use in this course. Below these, are headings for the Course Content (containing the weekly activities such as video lectures and homework assignments) and Course Tools (containing the “Check Grades” page, which details your scores for assignments and exams, and the “Send Email” page, which can help you send an e-mail to me or others in the course). The final heading is “Resources,” under which you will find links to pages with information on resources and services available to you online and on-campus.

Course Requirements

- **Textbooks and/or Course Materials**

Available for Free on our Blackboard Course Site: “**Math 506, Introduction to Number Theory**” by Todd Cochrane. (This text was used for a similar course at another university. You should disregard the course number given in the book’s title as well as any mention the book gives of homework problems.)

- **Technical Requirements**

- **A Reliable Computer:** a dedicated computer with an updated operating system, such as Windows 7 or later, or Mac OSX.
- **High-Speed Internet Connection:** (e.g. DSL or Cable). All USI online students are required to have a stable high-speed Internet connection. A wired Internet connection is recommended for online meetings, exams, and assignment submissions.
- [Office 365](#) (USI login needed) & [Adobe Acrobat Reader](#) installed.
- **Supported Web Browser:** [Firefox](#), [Google Chrome](#), or [Safari](#).
- Microphone & Webcam (for use with Zoom video-conferencing software)

* More information on the system requirements for taking online courses can be found at [USI Online Learning System Requirements](#)

Minimum Technical Skills

Students will be expected to be able to navigate and upload documents on BlackBoard; read PDF files; scan and save their hand-written work as PDF files; create, watch, and comment on VoiceThread presentations; use the online homework platform WebWork; use Zoom video-conferencing software; complete scheduling requests via Doodle polls; and (optional) type their homework neatly for weekly written homework submissions.

Assessments

- Weekly Written Homework Set
- Weekly Online Homework Set
- Zoom Problem Presentations and Discussions (roughly twice every three weeks)
- VoiceThread Discussions (roughly once every three weeks)
- Two Proctored Midterm Exams
- Cumulative Proctored Final Exam

Outside Resource Use

You are not permitted to use the internet or other books to find solutions for homework assignments or exams in this course. You are welcome to use sources on the internet and other books/textbooks to read more about the topics we discuss (e.g., to read alternative proofs given in the lectures or our textbook or to see more examples on a given topic). You are also welcome to discuss homework with others currently in our class, but all of the work that you submit should be your own work.

Zoom Problem Presentation Expectations

Students will regularly present problems in small groups on Zoom. These presentations (along with the group's discussion of the presentations) will be recorded and graded.

- Each student is expected to present a Problem from the week's homework set during each Zoom Problem Presentation meeting. No two group members may present the same problem. Because of this, it is recommended that each group use the first few minutes of each meeting to decide which problem each group member will present.
- Your presentations should be directed at your fellow group members, not the professor. Apart from a short time during your group's first Zoom meeting, the professor will not be present in your group's Zoom meetings. The meeting will be recorded, and grading will be based on what is in the recording.
- Your fellow group members may ask you questions during or after your Problem Presentation to clarify any points of confusion, which you should answer to the best of your ability.
- Prior to each Zoom meeting, all group members should have attempted every Problem to the best of his/her ability so that each group member has solutions written out neatly and completely prior to the Problem Presentations.
- Your work should be written and presented in complete sentences, with appropriate notation and terminology being used, and with all details explained.
- After each Problem Presentation, your group should decide whether there is anything in the presented solution that should be modified or corrected. Each group is responsible for determining whether Problem Presentations contain clear, correct, and complete solutions, and all students are responsible for understanding the material that is discussed during the Problem Presentations.
- At the end of each discussion of each Problem Presentation, the original presenter should briefly present his/her problem again to the group—including any modifications the group believed should be made for either clarity, completeness, or correctness. This may be skipped if the group believes that no or only minor changes of the original solution should be made.

Grading of Zoom Problem Presentations and Discussions

Each student may earn up to 8 points during each group Zoom meeting. Half of these points will be given based on your Problem Presentation, and half of these points will be given based on your contribution to the discussion of each Problem presented.

Zoom Problem Presentations will be graded using the following rubric:

Grade	Criteria
4	The final proof or solution is completely correct, well-written, and clear.
3	The final proof or solution is mostly correct. It may either contain minor flaws or lack a couple small details.
2	Some effort is made and is well-expressed, but the solution is incomplete, lacks several details, or is missing a significant step that is needed to be a full proof or solution.
1	Minimal progress has been made that is relevant to a proof or solution.
0	Little to no relevant work is shown.

Zoom Problem Discussions will be graded using the following rubric:

Grade	Criteria
4	Student listens respectfully, engages in the discussion, asks relevant questions, gives relevant and well-supported answers, and uses accepted mathematical terminology. Student helps lead the group to a complete and correct solution of each problem.
3	Student listens respectfully and engages in the discussion using accepted mathematical terminology, but the student is unprepared to ask relevant questions or give relevant and well-supported answers. Student helps lead the group to a complete and correct solution of each problem.
2	Student listens respectfully and asks some questions; however, the student is unprepared to answer questions or discuss problems in detail.
0	Little to no input is given, student is not present for a large portion of the Zoom meeting, student distracts others in discussion, or student does not ask or answer any questions.

VoiceThread Discussion Expectations

About every third week (starting with Week 1, Week 4, etc.) students will be expected to participate in a peer Question and Answer VoiceThread Discussion on the Weekly Homework Set. There will be two rounds of discussion for each VoiceThread Discussion.

Round 1: These initial posts should be completed by Thursdays at 11pm.

1. Give a helpful hint or key idea to two different Problems on the week's homework set.
2. Ask one relevant and meaningful question on another Problem which you may be stuck on or were stuck on for a significant amount of time. (You may ask more than one question.) Note: Asking "How do I do this problem?" is **not** a meaningful question.

Round 2: This response post should be completed by the following Sunday at 11pm.

1. Answer or respond meaningfully to one other student's question (i.e. you will not be given credit for responding to your own question). You should not answer the same question that someone else already has unless you have a correction or significantly different answer to offer.

Grading VoiceThread Discussions

Each VoiceThread Discussion will be graded as follows out of 8 points:

- 2 points will be given for **each of two** helpful hints or key ideas given in Round 1. (4 points possible)
- 2 points will be given for your relevant and meaningful question asked in Round 1.
- 2 points will be given for your answer or meaningful response to another student's question.

Grading of Weekly Exercises and Problems

For each weekly homework assignment, part of the assignment will be done online using Webwork and part will be a written homework assignment. The points and number of attempts available for the online homework assignments may vary but will be specified for each problem. Written homework assignments may consist of Exercises and Problems. Each Exercise will be graded out of 5 points and two Problems will be selected for grading, each also worth 5 points. For example, if Week 31's Homework Assignment contained three Exercises and seven Problems, it would be graded out of 25 points—15 points for the Exercises and 10 points for some two of the Problems that are selected by the instructor.

Written solutions to Exercises and Problems will be graded using the following rubric:

Grade	General Criteria
5	The solution is completely correct, well-written, clear, and contains sufficient supporting work*.
4	The solution is mostly accurate but may be incomplete (lacking a small detail in the supporting work) or may contain a minor technical or stylistic error (e.g., using the equals sign incorrectly or failing to use it when necessary).
3	The solution contains a more serious technical or stylistic error or is lacking a more significant detail, but most of the relevant work is shown and is largely well-expressed.
2	The solution shows some insight into the correct solution but lacks sufficient supporting work, contains a significant error, is only partially completed, or is missing a significant step that is need for a complete proof/solution.
1	The solution is largely incorrect or incomplete; minimal progress has been made that is relevant to a correct solution.
0	No solution is given, little to no relevant progress is made toward a correct solution, or little to no supporting work is given to accompany the final answer.

*One way to help you know what is meant by “sufficient supporting work” is to consider the following question: Would another student in this class, who does not know how to solve this problem, be able to learn how to solve it and similar problems solely by reading my solution?

Proctored Exams

You will be given two regular exams and one final exam for this course. All of these exams will be proctored by me either in-person on the USI campus or over Zoom. (Both options will be given to all students for each of these three exams.)

Exam 1 will be over material covered in Weeks 1 through 5 (i.e. through Section 3.4 in the textbook apart from Section 2.2). Exam 2 will cover material from Week 7 through Week 11 (i.e. Section 2.2 and Section 4.1 through Section 5.5). The final exam will be cumulative.

Grading Methods

Assignment	Due Dates	Percentage of Course Grade
Your Introduction Video	Thursday, August 24th	1%
Weekly Homework Set (written and online)	varies (usually Mondays)	13%
Zoom Problem Presentations and Discussions	varies by group	11%
VoiceThread Discussions	varies	10%
Proctored Midterm Exam 1	Friday, TBA	20%
Proctored Midterm Exam 2	Friday, TBA	20%
Cumulative Proctored Final Exam	TBA	25%
	Total:	100%

	A	B	C	F
Percentage	90-100%	80-89.9%	70-79.9%	Below 70%

Course & University Policies

Late Assignment Policy

Students are expected to complete all assigned work in a timely manner. **It is highly recommended that students submit work early to avoid problems. Having technical problems will not be an acceptable excuse.** Late homework and discussion posts work will lose 25% of the maximum possible grade per day. (In particular, four days after a homework assignment or discussion post is due, you will not be able to earn any points on the assignment.) Late work includes unreadable, unintelligible, or inaccessible content as well as material that does not follow the guidelines of the assignment. Zoom meetings and exams will not be accepted late. Details about specific assignments and their deadlines can be found on BlackBoard. **If an unforeseen emergency occurs and keeps you from submitting your work on time, then you should e-mail me as soon as you can.**

Academic Integrity

Students have the right and responsibility to pursue their educational goals with academic integrity, which is the hallmark of truth and honesty in an engaged university community. Please view the [Academic Integrity Policies and Procedures](#).

AI Tool Use

Artificial intelligence (AI) tools that generate text, images, code, AI, and other content are widely available. If you submit work containing any content generated by AI when not explicitly allowed and not in a way directed by me, the instructor, then this will be considered academic dishonesty and a violation of USI's academic integrity policy. If you are not sure about what may be academic dishonesty or plagiarism and what is acceptable use in this course and on specific assignments, then please contact me.

You are not permitted to use AI tools that generate content (such as ChatGPT, Bing Chat, Bard, DALL-E) for work done for this class. Writing, analytical, and critical thinking skills are part of your learning outcomes in this course; therefore, all writing assignments should be prepared by you, the student. Content created by AI tools may not be considered your own original work.

This course assumes that work submitted by students (all process work, drafts, final versions, and all other submissions) will be generated by the students themselves, working individually or in groups (as directed).

Course Materials Sharing Statement

Students may not replicate, share, or post course-related materials on any platform outside of the Blackboard course site (such as public online “study” sites) without instructor permission. Please see USI’s [Students Rights and Responsibilities](#) documents for further information.

SafeAssign

Plagiarism and cheating constitute academic misconduct and can result in both a grade penalty imposed by the instructor and disciplinary action including suspension or expulsion. As part of their responsibility to uphold the Student Code of Conduct, instructors reserve the right to have papers submitted through SafeAssign to check for plagiarism against a database of papers submitted previously at USI, a national database of papers, and the Internet. Self-plagiarism can also occur when you plagiarize yourself if you submit for credit a piece of work that is the same or substantially similar to work for which you have already gained or intend to gain university credit, at this or any other university. To avoid self-plagiarism, you must have prior permission from the relevant instructor(s) and give full attribution to the source (i.e., yourself). Safe Assign can be used to check against any earlier submitted student assignments or presentations.

Civility Statement

The University is dedicated to a culture of civility among students, faculty, and staff. The university embraces and celebrates the many differences that exist among the members of a dynamic, intellectual, and inclusive community, and strives to maintain an environment that respects differences and provides a sense of belonging and inclusion for everyone. If you have experienced discrimination, or know someone who has, you may seek help by contacting USI’s Affirmative Action Officer, Chelsea Keaton, at 812-464-1703 or at title.IX@usi.edu. Find more information in the [Student Rights and Responsibilities: Code of Student Behavior](#) and [Equal Opportunity and Non-Discrimination policy](#).

Disability Accommodations

If you have a disability for which you may require academic accommodations for this class, please contact Disability Resources at 812-464-1961 or email Disability Communications at usi1disres@usi.edu as soon as possible. Students are approved for accommodations by Disability Resources should request their accommodation letter be emailed to them to forward to their online instructors. Due to the nature of online courses, some accommodations approved for on campus courses may not apply. Please discuss this with Disability Resources to clarify as needed. Students who receive an accommodation letter from Disability Resources are encouraged to discuss the provisions of those accommodations with their professors before or during the first week of the semester. If you will be in an internship, field, clinical, student teaching, or other off-campus setting this semester please note that approved academic accommodations may not apply. Please contact Disability Resources as soon as possible to discuss accommodations needed for access while in this setting. For more information, please visit the Disability Resources website at [USI Disability Resources](#).

Class Withdrawal & Incomplete Policy

It is the student’s responsibility to officially drop/withdraw from any courses before the deadline. The university does not withdraw students from any classes. Please refer to the [USI Academic Calendar](#) for specific dates. For more information, please visit [Registrar’s Office Schedule Changes](#).

Under special circumstances, students may petition for an incomplete grade. However, it is up to the course instructor to decide if an incomplete will be granted. Students receiving an incomplete grade will need to complete all course requirements by the agreed deadline to avoid an “F” grade.

Title IX, Sexual Assault, and Gender Violence Policy

The University of Southern Indiana is committed to providing a safe learning, living, and working environment free from discrimination. Sexual misconduct and incidents of interpersonal violence deeply interrupt the collegiate experience, and USI is dedicated to ensuring a campus that is free of these types of incidents in order to promote community well-being and student success.

USI encourages individuals who believe that they have been sexually harassed, assaulted, or subjected to sexual misconduct to seek assistance and support. Confidential resources are available on campus at [Counseling and Psychological Services](#) (CAPS) and the [University Health Center](#) (UHC).

As Responsible Employees, all faculty, staff, and administrators of the University community (Except those noted above) are not considered confidential resources and are required to report incidents of sexual misconduct to the University Title IX Coordinator. The University will work with complainants to protect their privacy by sharing information with only those who need to know to ensure that USI can respond and assist. For a full list of resources, support opportunities, and reporting options, contact Chelsea Givens, the University Title IX Coordinator, at 812-464-1703. Additionally, you may email the office at TitleIX@usi.edu or stop by the Institutional Equity Office located in the Wright Administration Building, Forum Wing, Suite 171.

Syllabus Change Policy

The syllabus is a guide to the course and is subject to change with reasonable advanced notice as course needs arise.

Technical Support

Help Desk Support

Since your professors are not trained as technology experts, they will not be able to assist you with your technical needs. Please contact the Help Desk at (812) 465-1080 or send an email to it@usi.edu for technical support. To learn more about the USI helpdesk, please visit [USI IT Help Desk](#)

- **Blackboard Support**

If you would like to speak to a support technician, you can call (812) 465-1080 during normal USI business hours (8am-4:30pm, Monday-Friday). Click on the following link for more [FAQ about Blackboard](#).

- **Zoom Support**

For issues involving [Zoom](#), please contact the Information Technology office at 812-465-1080 or send an email to it@usi.edu. For additional Zoom tutorials, please go to [Zoom Support](#).

Online Learning Office Support

- **VoiceThread Support**

- [USI Online Learning VoiceThread Tutorials](#)

For issues involving VoiceThread, please contact Online Learning at (812) 228-5124 or send an email to online.support@usi.edu. The following link will direct you to tutorials on how to use VoiceThread <https://voicethread.com/howto/>

Privacy Policies & Accessibility Statements

For detailed information about the privacy policies and accessibility statements of the course technologies, please visit [USI Online Learning Support Services](#)

Additional Student Resources

The university provides a comprehensive range of support services and activities for students. Please refer to [Student Support Services](#) for detailed information regarding academic advising, registration, financial aid, student affairs, counseling, career services, etc.

Online Learning Library Services

<https://usi.libguides.com/onlinelearning>

Research Guides

Research assistance, subject guides, and useful resources compiled by your friendly librarians.

<http://usi.libguides.com/>

Counseling Center

The Counseling Center is open every Monday through Friday from 8:00 am to 4:30 pm. You'll find the Counseling Center in the Orr Center, Room 1051; their phone number is (812) 464-1867

<http://www.usi.edu/counselingcenter/>

Disability, and ADA Support

<http://www.usi.edu/university-division/disabilities>

Student Grievances

[Student Grievances and Complaints Information](#)

Additional Student Resources

The university provides a comprehensive range of support services and activities for students. Please refer to <http://www.usi.edu/students/> for detailed information regarding academic advising, registration, financial aid, student affairs, counseling, career services, etc.

- **University Health Center**-The University Health Center is a full-service clinic offering medical services and health-related information to students, faculty, and staff. It located in the lower level of the Health Professions Center and is open Monday through Friday, 8 am to 4:30 pm. Click on this link to learn more about the [Health Services](#) offered at USI, or to make an appointment, please call (812) 465-1250.
- **Financial Aid Office**- Information about current or future financial aid (including the implications of withdrawal from courses) can be obtained from the University Financial Aid Office. The office open is every Monday through Friday from 8:00 am to 4:30 pm; phone (812) 464-1767, or email them at finaid@usi.edu