MATH 3307

Elementary Number Theory

FALL 2016
T/TH 3:30-4:50 in PKH 105

Instructor: **Dr. J. Epperson**
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Office Hours: M & W 1-2 & by appointment

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Faculty Profile:
http://www.uta.edu/profiles/james-epperson

COURSE PREREQUISITES: 2.0 or better in nine hours of college mathematics.

COURSE DESCRIPTION: Various topics in elementary number theory including divisibility, congruences, quadratic reciprocity, and multiplicative functions.

LEARNING OUTCOMES: Upon completing this course, students should be able to:

1. Prove statements and solve problems involving divisibility, prime numbers, and the Euclidean Algorithm;
2. Solve linear Diophantine equations and various types of congruence problems, and use the theory of congruence in applications;
3. Apply properties of multiplicative functions such as the Euler phi-function and quadratic residues.

ELECTRONIC COMMUNICATION STATEMENT:

UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

TEXTBOOK:

Number Theory Through Inquiry by D. Marshall, E. Odell, & M. Starbird

(ISBN 978-0-88385-751-9)

Note: PDF version available or $25.00 at http://www.maa.org/press/ebooks/number-theory-through-inquiry

MATERIALS:

- Binder(s) and paper for keeping class handouts and work.

GRADES	
Exam I	20%
Exam II	20%
Homework	15%
Attendance/Engagement /Presentations	15%
Final Exam	30%
Total	100%

CLASS FORMAT:

The class will be conducted using a method of instruction called Inquiry Based Learning or Guided Discovery or the Modified Moore Method. This method fosters creativity and independent thinking. It is also fun. Your book contains lists of questions and theorem statements without proofs. You will answer the questions and prove the theorems on your own and present your results to the class. These presentations are a major part of the course. The ideal model to follow is to settle the questions and prove the theorems independently and write-up your solutions before the answers are presented in class. You may not consult books (other than your text), the Internet, other people, or other sources. At times, your instructor may ask you to collaborate on a theorem or exercise. The nature of the collaboration is inquiry-based and not "answer telling" or "answer getting." On collaboration problems, the instructor will always let you know in advance when you are allowed to collaborate.

Each day, I will select students to present their solutions or proofs in class. Your standing assignment is to be prepared to present your results. When you are presenting your proofs or solutions, strive to make your explanations clear and organized. When you are observing a presentation, it is your responsibility to follow the logic of the solution and verify that it is correct for yourself. You may be asked during class to re-explain an argument that you just heard. If you cannot follow the reasoning, *it is your responsibility to ask a question of the student presenting*. If you are truly stuck on a question or proof outside of class, do not hesitate to ask the instructor for help. You should be working far enough ahead of the classroom presentations so that there is time for this consultation.

DETAILS ABOUT THE COURSE

Grades will be assigned using the following scheme (approximate):	90-100	A
	80-89	B
	70-79	C
	60-69	D
	59 or Below	F

LATE WORK: In general, late work will not be accepted. One half of the assigned points will be deducted for work that is submitted after the due date if there is a legitimate and documentable excuse.

ATTENDANCE: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

As the instructor of this section, since the majority of this work relies upon presentations and student engagement questions during class time, regular attendance is critical. You are expected to be in class, on time, each day. Students missing class for a University Event, religious reason, or other 'pre-scheduled' reason must contact the instructor prior to the event and discuss reasonable accommodations. Everyone

begins with 100 attendance points. Five points will be *deducted* for each absence. If you contact the instructor prior to the beginning of class (and receive confirmation of receipt of message), only two points will be deducted for that day's absence. Two points will be *deducted* for each tardy after the first. If you leave class early, or choose not to participate, points will be *deducted* accordingly.

HELP OUTSIDE OF CLASS: My office hours are listed on the first page of this syllabus. These are times when I will be available, in my office, to discuss the material/homework/tests. No appointment is necessary for those times. If, however, those times are inconvenient for you, then please make an appointment with me for another time (e.g., e-mail me stating the times you prefer). *Please use the subject heading "**MATH 3307 Student Question**" when sending Dr. Epperson an e-mail and identify yourself (full name) in the communication.*

Personal Technology Use: Cellular phones should either be switched off or set to silent mode during all class meetings. Cellular phone use will not be permitted during class. If you must take an important phone call, please leave the classroom. Cellular phone use is prohibited during exams. If you have a watch, or other device, that beeps please turn this off during class meetings as it is disruptive for other students. *As class time for this course focuses on interpersonal interactions, students must request permission to use a laptop or tablet during class. Inappropriate use will result in loss of this privilege.*

Homework: Your standing homework assignment is to write up solutions to all assigned questions and theorems in your book *Number Theory Through Inquiry* before they are presented in class. You will submit your solutions on a daily basis. Please make every effort to keep your solutions neat and clean, and try to leave space for comments as necessary. You should also keep a notebook containing all your notes and copies of your solutions and proofs; this will serve as your personal textbook for this course, and will help you study for exams. Writing up the proofs and solutions is an excellent way for you to learn the mathematics.

Exams: There will be two hour-exams during the semester. Each will be announced at least one week in advance. There are no make-up exams. The final examination will be comprehensive. On exams, you may only use nonprogrammable calculators with basic computational features, such as arithmetic and transcendental functions. You may NOT use any calculator with the following capabilities: graphing, equation solving, factoring, greatest common factor, least common multiple, differentiation, integration, QWERTY keyboard, or any device that has internet capabilities (This means NO CELL PHONES, TABLETS, ETC).

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

If at any time you have questions, please do not hesitate to ask.

Course Schedule[1]:

Day	Date	Topic(s): Homework (due following class period)
1	25-Aug	First Day of Class; Divisibility: 1.1-1.8
2	30-Aug	Divisibility and Congruence: 1.9-1.14, A.10, A. 18
3	1-Sep	Divisibility and Congruence, Mathematical Induction: A.30, A.31, 1.15-1.20
4	6-Sep	Division Algorithm: 1.21-1.23, 1.25-1.28
5	8-Sep	Greatest common divisors and linear Diophantine equations: 1.29-1.36
	12-Sep	CENSUS DATE
6	13-Sep	Greatest common divisors and linear Diophantine equations: 1.37-1.43
7	15-Sep	Greatest common divisors and linear Diophantine equations: 1.45-1.51, 1.53-1.54
8	20-Sep	Greatest common divisors and linear Diophantine equations: 1.45-1.51, 1.53-1.54, 1.59
9	22-Sep	Fundamental Theorem of Arithmetic: 2.1-2.5, 2.7-2.9
10	27-Sep	Applications of the Fundamental Theorem of Arithmetic: 2.19-2.23, 2.25-2.27
11	29-Sep	The infinitude of primes: 2.32-2.35, 2.37-2.38, 2.49
12	4-Oct	Review
13	6-Oct	**Exam I**
14	11-Oct	Powers and polynomials modulo *n*: 3.1-3.5
15	13-Oct	Powers and polynomials modulo *n*: 3.7-3.10, 3.14-3.17
16	18-Oct	Linear Congruences: 3.18-3.22, 3.24 (3 parts)
17	20-Oct	Linear Congruences: 3.18-3.22, 3.24 (3 parts)
18	25-Oct	Linear Congruences: 3.25-3.29, 3.30
19	27-Oct	Orders of an integer modulo n & Fermat's Little Theorem: 4.1-4.8
20	1-Nov	Fermat's Little Theorem: 4.9-4.18
	2-Nov	Last Day to Drop Classes - by 4 p.m.
21	3-Nov	Fermat's Little Theorem, Euler's Theorem & Wilson's Theorem: 4.19-4.23, 4.27-4.30
22	8-Nov	Euler's Theorem & Wilson's Theorem: 4.31-4.39
23	10-Nov	Euler's Theorem & Wilson's Theorem: 4.40-4.42, 4.43
24	15-Nov	Public Key Cryptography & Review: 5.1-5.7
25	17-Nov	Review
26	22-Nov	**Exam II**
27	29-Nov	Polynomial Congruences and Primitive Roots: 6.1-6.3, 6.23
28	1-Dec	Quadratic Reciprocity: 7.1-7.9, 7.14, 7.16, 7.19
29	6-Dec	Quadratic Reciprocity: 7.1-7.9, 7.14, 7.16, 7.19
30	15-Dec	**FINAL (Comprehensive) EXAM 2-4:30 p.m.**

[1] As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled. – Dr. James A. Mendoza Epperson

If at any time you have questions, please do not hesitate to ask.

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

If you require an accommodation based on disability, I would like to meet with you in the privacy of my office, during the first week of the semester, to make sure you are appropriately accommodated.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

If at any time you have questions, please do not hesitate to ask.

Grade Replacement and Grade Exclusion Policies: These policies are described in detail in the University catalog and can also be founded online at
http://catalog.uta.edu/academicregulations/grades/#undergraduatetext

Student Disruption: The University reserves the right to impose disciplinary action for an infraction of University policies. For example, engagement in conduct, alone or with others, intended to obstruct, disrupt, or interfere with, or which in fact obstructs, disrupts, or interferes with, any function or activity sponsored, authorized by or participated in by the University.

Drop for Non-Payment of Tuition: If you are dropped from this class for non-payment of tuition, you may secure an Enrollment Loan through the Bursar's Office.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Important Dates:

First Day of Classes	25 August
Labor Day Holiday	05 September
Census Date	12 September
Exam I	6 October
Drop Date	2 November, by 4 pm
Exam II	22 November
Thanksgiving Holiday	24 -25 November
Last Day of Classes	07 December
Final Exam	15 December, 2:00-4:30 pm

If at any time you have questions, please do not hesitate to ask.