

Math 3150B-001 Course Outline (Winter 2022-23)

Elementary Number Theory I

Course schedule, location, and delivery mode:

In-person: Mondays, Wednesdays and Fridays, 2:30-3:30 pm, in TC 203.

Instructor information:

Instructor: David Riley, Professor of Mathematics

Contact information: dmriley@uwo.ca, MC 136. Due to the ongoing pandemic, I prefer to answer all simple questions by email. However, I will post in-person office hours on OWL soon. Remember: students *must* use their Western (@uwo.ca) email addresses for all University correspondence.

Prerequisites:

A 1.0 course in Mathematics, Applied Mathematics, or Calculus at the 2100 level or higher is required. *Unless you have either the prerequisites for this course or written special permission from your Dean to enrol in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.*

Course materials:

Textbook: *Number Theory: in Context and Interactive*, by Karl-Dieter Crisman. This textbook has been provided free by the author online. It has SageMath-based interactive functions when used online. It is also available for download as a pdf from the same website – but without the live SageMath visualizations.

OWL statement: Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Course syllabus (as time permits):

- Basic questions about integers (Chapters 1-3)
- Basic congruences and primes (Chapters 4-7)
- A more advanced point of view of integers and congruences, including groups, to attack cryptography efficiently (Chapters 8-12)
- Sums of squares and quadratic reciprocity (Chapters 13, 16, 17)
- Introduction to arithmetic functions (Chapter 18)
- Introduction to the prime counting function (Chapter 21)

Course-level learning outcomes:

- Demonstrate knowledge and critical understanding of the basic principles within Elementary Number Theory.
- Demonstrate the capability to use a range of established techniques and a reasonable level of skill in calculation and manipulation of the material to solve problems in the following areas: the Division and Euclidean Algorithms, congruences, the Chinese Remainder Theorem, primes and the Fundamental Theorem of Arithmetic, Wilson's and Fermat's theorems, basic group theory, units and Euler's phi function, primitive roots, basic cryptography, primality testing and factorization, sums of squares, quadratic residues, basic arithmetic functions, prime counting.
- Apply the concepts and principles in Elementary Number Theory in well-defined contexts beyond those in which they were first studied, showing the ability to evaluate critically the appropriateness of different tools and techniques.

What is expected of the student:

Students should attend all classes, make a serious effort to understand all course material, and do all of the assigned work. The student must assume responsibility for any missed classes. It is up to the student to seek out help when needed. Students are expected to keep up with the material of the course by reading and learning definitions, theorems and results, and doing additional practice problems. They should review all learning materials in a timely fashion, follow class announcements, complete all assignments, and write all examinations. Solutions of collected homework problems must be written neatly and submitted using GradeScope.ca by the deadline. A fundamental component of the course is to *prove* mathematical theorems.

Method of evaluation:

Breakdown: six assignments worth a total of 25%, one in-person Midterm Exam worth 30%, and one in-person Final Exam worth 45%. The lowest of your six

assignment marks will be dropped in the calculation of your assignment component; in other words, each of your five best assignments is worth 5%.

Tentative due dates for assignments: January 20, February 3, February 17, March 17, March 31, April 10.

Tentative Midterm Exam date: March 3 (in-class).

Policies for assignments: All assignments must be submitted using GradeScope.ca. *No late submissions will be accepted.*

Student Absences:

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth less than 10% of the overall course grade: The only assessments worth less than 10% in this course are the individual assignments. If you miss precisely *one* assignment during the course, for any reason, all *five* of your remaining assignment marks will be used to calculate the assignment component of your course grade. If you miss any *additional* assignments due to medical or non-medical reasons, you must contact your *instructor*, as soon as possible, to apply for accommodation. Please do *not* send your instructor any private information, such as a Student Medical Certificate. If accommodation is granted, the corresponding 5% weight of each additional missed assignment will be added to the weight of your final exam component.

Assessments worth more than 10% of the overall course grade: For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf. The Student Medical Certificate is available at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

If you miss the Midterm Exam and *accommodation is granted by your Academic Counselling Office*, the corresponding 30% weight of your missed midterm exam will be added to the weight of your final exam.

Absences from Final Examination: If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

Note: Missed work can only be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is not sufficient on its own.

COVID-19 contingency plan:

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will *not* change. Any remaining assessments will also be conducted online as determined by the course instructor.

Accommodation and accessibility:

Religious accommodation: When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Accommodation policies: Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

Academic policies:

The website for Registrarial Services is <http://www.registrar.uwo.ca>. In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

No electronic devices (calculators, cell phones, etc) will be allowed in any exam.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following website:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

In the event of a health lockdown, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca>.

Support services:

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at http://academicssupport.uwo.ca/accessible_education/index.html if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.