Math 261 — Fall 2022
Number Theory
https://sites.aub.edu.lb/kmakdisi/

Classes: MWF 12–12:50 in Nicely 324.

Professor: Kamal Khuri-Makdisi, Bliss 311, phone 4234. The best way to contact me is to send e-mail to **kmakdisi@aub.edu.lb** . My office hours are tentatively MW 3–5. You can also contact me by e-mail or through the discussion forum in Moodle.

Required textbook: Davenport, *The Higher Arithmetic*, eighth edition, available at the University Bookstore. (The seventh edition is also okay.)

Optional, but useful, supplementary textbooks:

- Niven, Zuckerman, and Montgomery, *An Introduction to the Theory of Numbers.*
- Hardy and Wright, *An Introduction to the Theory of Numbers* (not a typo — it's exactly the same title as for Niven, Zuckerman, and Montgomery). This book is a great classic.
- Peter Hackman, *Elementary Number Theory*, online at
  https://hackmat.se/kurser/TATM54/booktot.pdf
- William Stein, *Elementary Number Theory*, online at
  https://www.williamstein.org/ent/

  This book assumes that you have seen some basic abstract algebra, on the level of the first half of Math 241. The presentation is quite nice if you have that prior background.
- Kenneth Ireland and Michael Rosen, *A Classical Introduction to Modern Number Theory.* You can download the book electronically from an AUB computer at the website
  https://link.springer.com/book/10.1007/978-1-4757-2103-4

  This book presents the material excellently, assuming you have a stronger background in abstract algebra (say Math 242).

Course requirements: The grade will be based on 15% weekly problem sets, 35% midterm, and 50% final. It is **very important** to keep up with the homework in this course, otherwise you will do badly on the midterm and the final exam. The problem sets will be challenging — it's the only way to really learn the mathematics. If there is sufficient background and interest, and if time allows, some of the assignments may involve computer work.

You may discuss homework problems with your classmates but you may **not** solve homework together. You must write your problem set **in your own words, based on your own understanding of the solution.** I encourage you to look up material in other books and articles, but if you use this resource in your solution of a problem, please give a reference to the text you used for each problem. **You MUST include in EACH problem set the names of any people you discussed the problem with, and full references to any books or websites you used in solving the problems.**

Prerequisites for this course: Mathematical maturity at a level equivalent to having taken Math 219; in particular, facility with proofs and abstract reasoning. Students from all majors are welcome, including from the Faculty of Engineering.

Topics to be covered: Here is a tentative list of the topics that we will cover, with the corresponding chapters in Davenport. The precise list of topics is subject to change.

- Prime factorization and Euclid's algorithm (Chapter 1, approximately 2 weeks)
- Congruences (Chapter 2, approximately 3.5 weeks)
- Quadratic reciprocity (Chapter 3, approximately 2 weeks)
- Some Diophantine equations (selections from Chapters 5 and 7, approximately 2.5 weeks)
- Continued fractions and Pell's equation (selections from Chapter 4, approximately 1.5 weeks)
- Quadratic forms (selections from Chapter 6, approximately 1.5 weeks)

I will cover other topics as time permits. If there is sufficient background and interest, we can cover some topics in elliptic curves, computational number theory, or cryptography.

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Other AUB Policies: By signing up for this course, you confirm that you have read and accepted the terms and provisions of AUB's **Privacy Statement** and policies on **Academic Integrity** and **Non-Discrimination**.