Syllabus - MATH 3450
Theory of Numbers
Fall \Winter 2011 \2012

Don't just read it; fight it! Ask your own questions, look for your own examples, discover your own proofs. Is the hypothesis necessary? Is the converse true? What happens in the classical special case? What about the degenerate cases? Where does the proof use the hypothesis? - Paul Halmos

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Office Hours:
Monday, Wednesday, & Thursday 9:00 - 10:00 ;

Lectures:
418 Machray Hall
11:30–12:50 Tuesday, & Thursday

Textbook:
I. Niven, H. S. Zuckerman, H. L. Montgomery, *An Introduction to the Theory of Numbers (5^{th} Ed.)*, Wiley, 1991

Tentative Topics:

- **Chapter 1: Divisibility**
  integers and natural numbers, factorization, Euclidean algorithm, primes, binomial theorem, fundamental theorem of arithmetic, prime number theorem (without proof)

- **Chapter 2: Congruences**
  modular arithmetic, Fermat's little theorem, Euler's ϕ-function, Wilson's Theorem, solutions to $n = a^2 + b^2$, linear congruences, Chinese remainder theorem, Pollard rho method, public key cryptography, Hensel's lemma, polynomial congruences, multiplicative order, primitive roots, quadratic residues, groups, rings and fields

- **Chapter 3: Quadratic reciprocity and quadratic forms** Legendre and Jacobi symbols, binary quadratic forms, class number, finding and counting solutions of $n = a^2 + b^2$ and similar forms.

- **Chapter 4: Number-theoretic functions**
  ceiling and floor (greatest integer function), multiplicative functions, Möbius inversion, recurrences.

- **Chapter 5: Diophantine equations**
  systems of linear Diophantine equations, Pythagorean triples, miscellaneous Diophantine equations. Later sections of Ch. 5 may be covered.

- ⋆ **Chapter 6: Farey fractions and irrational numbers**
  Farey sequences, rational approximations, proving numbers to be irrational. Topics from 6.4 may be covered, depending on time and interest.

- ⋆ **Chapter 7: Continued fractions**
  existence and uniqueness of finite and infinite continued fractions, best approximations, irrational numbers. Later topics may be covered, depending on time and interest.

- ⋆ **Later Chapters**
  We may go further in the text, or we may go outside the text, in the Spring. If so, I will endeavor to provide notes where they are called for.

Evaluation of Student Performance:

Project	15 %	To be assigned early second term
Assignments	10 %	Given about every two weeks
Midterm Tests	30%	Two test, (each worth 15%) written in class
Final Examination	45%	(3 hours) - to be scheduled

Midterm Tests:

There will (tentatively) be midterms in class on:
November 22^{th} (2011) and February 14^{th} (2012)

Website:

http://home.cc.umanitoba.ca/∼ davidsom/

Notes:

- ◇ The Voluntary Withdrawal Deadline is Friday, March 16^{th}.

- ◇ No Class Days (2011): Monday October 10^{th} (Thanksgiving) and Friday November 11^{th} (Remembrance day)

- ◇ No Class Days (2012): Monday February 20^{th} to Friday February 24^{th}

- ◇ Note that past examinations are to be used for practice only: there is no guarantee that your examinations in this course will in any way be similar.

- ◇ If you miss a midterm, you will be assigned a grade of 'zero' unless reasons and acceptable supporting evidence are provided.

- ◇ No late assignments will be accepted.

Faculty of Science Statement on Academic Dishonesty

The Faculty of Science and The University of Manitoba regard acts of academic dishonesty in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.

Acts of academic dishonesty include, but are not limited to bringing unauthorized materials into a test or exam, copying from another individual, using answers provided by tutors, plagiarism, and examination personation.

Note: cell phones, pagers, PDAs, MP3 units or electronic translators are explicitly listed as unauthorized materials, and must not be present during tests or examinations.

Penalties that may apply, as provided for under the University of Manitoba's Student Discipline ByLaw, range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University. The Student Discipline ByLaw may be accessed at:

`http://umanitoba.ca/admin/governance/governing_documents/students/868.htm`

Suggested minimum penalties assessed by the Faculty of Science for acts of academic dishonesty are available on the Faculty of Science webpage:

`http://umanitoba.ca/faculties/science/resources/Discipline_Penalties_Table_Jul09.pdf`

All Faculty members (and their teaching assistants) have been instructed to be vigilant and report all incidents of academic dishonesty to the Head of the Department.