# MATH 312: INTRODUCTION TO NUMBER THEORY

UBC, SUMMER TERM 2016: MAY 09 TO JUN 16

### 1. General Information

**Instructor:** Nuno Freitas

Office: Mathematics Building, room 209

e-mail: nuno@math.ubc.ca

Lecture room: Leonard S. Klinck (also known as CSCI) building, room 201

Lecture time: Tue Thu Fri 10:00-12:00 and Wed 9:30-10:30

Office hours: Tue 13:00-14:30 and Wed 10:30-12:00

Website: http://www.math.ubc.ca/~nuno/math312S16.html

Textbook: K. Rosen, Elementary Number Theory, 6th edition.

#### 2. EVALUATION

Grading Scheme: Midterm 30% plus final 70%.

**Homework:** A list of suggested problems will be made available weekly. 40% of the midterm and final exam will constitute of listed problems.

**Exams:** All exams will be closed-book, closed-note, no calculators. You are required to be present at all examinations. Non-attendance will result in a mark of zero being recorded. No make up midterm will be given. If you must miss the midterm and you have a documented medical reason, then you may request to have the weight of the midterm transferred to the final exam.

Date for the midterm Friday the 27th of May.

The midterm will cover material up to the class of Thursday 26th of May. A reasonable approximation should be everything up to topic 6.3 (inclusive) in the list below.

### 3. Description

This is a first course in number theory, aimed at students who have some (but not necessarily much) experience with reading and writing proofs. Specifically, it will be assumed that students are familiar with basic techniques of mathematical proof and reasoning such as induction and proof by contradiction.

# Sections of the book that we will (at least partially) be covered.

During the course, it is better to consult the course website for the most up-to-date schedule and references.

- 1.3 Induction;
- 1.5 Divisibility;
- 3.1. Prime numbers;
- 3.2. The distribution of primes;
- 3.3. Greatest common divisors;
- 3.4. The Euclidean algorithm;
- 3.5. The fundamental theorem of arithmetic;
- 3.6. Fermat Factorization;
- 3.7. Linear Diophantine equations
- 4.1. Introduction to congruences;
- 4.2. Linear congruences;
- 4.3. The Chinese Remainder Theorem
- 5.1. Divisibility tests;
- 5.5. Check digits (ISBN code only)
- 6.1. Wilson's Theorem and Fermat's Little Theorem;
- 6.2. Pseudoprimes;
- 6.3. Euler's Theorem
- 7.1. The Euler phi-function;
- 7.2. The sum and number of divisors;
- 7.3. Perfect numbers and Mersenne primes;
- 8.1. Character ciphers;
- 8.3. Exponentiation ciphers
- 8.4. Public key cryptography
- 8.6. Cryptographic protocols and applications (digital signatures only)
- 9.1. The order of an integer and primitive roots.
- 9.2. Primitive roots for primes.
- 9.3. The existence of primitive roots.
- 9.4. Discrete logarithms and index arithmetic.