Math 255 - Spring 2018
Final Exam Information

The Final Exam will be in our usual classroom (Lafayette 102) on Thursday May 10 between 10:30am and 1:15pm. It is cumulative, with some emphasis on the material covered since Exam 2.

Please note this important Final Exam University policy:

> Students who are absent from a final exam for any reason must report that fact and the reason, in writing[1], to their instructor within 24 hours. If the absence is due to any situation beyond the reasonable control of the student (e.g., illness or family tragedy), the instructor must provide the student with the opportunity to complete the course requirements. At the instructors discretion, this may be an exam or some other suitable project. The instructor may require evidence in support of the student's reason for absence.

Please read these instructions carefully, as not heeding them will constitute a breach of the UVM Code of Academic Integrity:

- You may not use a calculator or any notes or book during the exam.
- You may not access your cell phone during the exam for any reason; if you think that you will want to check the time please wear a watch.
- The work you present must be your own.
- Finally, you will more generally be bound by the UVM Code of Academic Integrity, with which you should familiarize yourself if you haven't already.

You will be asked to acknowledge that you have read these instructions on the first page of the exam.

For each problem, you should write down all of your work carefully and legibly to receive full credit. For each question, you should use theorems and/or mathematical reasoning to support your answer, as appropriate.

To help you study for this exam:

- There will be extra office hours during finals week on:
  - Monday from 3:30pm to 5:30pm
  - Tuesday from 1pm to 3pm
  - Wednesday from 3pm to 5pm

  I will also be available on Piazza during the week. Please do not expect me to answer email/Piazza for twelve hours before the exam. You should be done studying by then and using that time to rest and relax anyway.
- Conceptually it might help you to think of the exam as having "two parts."
  - The first part is a review of the material covered by Exams 1 and 2. This will cover the main ideas of this part of the class. To prepare for this part of the exam you should review Exams 1 and 2 from this semester thoroughly, and focus on the homework, quizzes and suggested problems that you struggled with.
  - The second part is comprehensive coverage of the material of that we have been covering since Exam 2. This material will be covered in greater depth. To prepare for this part of the exam you should

[1] Email is fine.

    * work the problems suggested between April 16 and May 4, as well as the quizzes administered during those dates,
    * review Homework 11 and 12,
    * and look at Exam 2 from Spring 2016 and 2017.

- Finally, two past final exams have been posted, and a practice final exam will be posted shortly. Solutions will be posted on Monday evening (please remind me if I forget). **The best practice for the final exam is the practice final exam.**

Things that could be on the Final Exam:

- As usual you may be asked to state theorems or definitions, or to decide if a conclusion follows from a theorem. More precisely:
  - Given any theorem (even one we have not studied!), state the hypotheses and the conclusion of the theorem and determine if the theorem can be applied to reach a certain conclusion.
  - You may be asked to state (and use!) an important theorem from class. Those are: the Division Algorithm (Theorem 2 of Section 1), Theorem 1 of Section 3, the Unique Factorization Theorem (Theorem 2 of Section 2), the Chinese Remainder Theorem (Theorem 2 of Section 5) and its generalization to solve simultaneous congruences when the moduli are not pairwise relatively prime, Fermat's Little Theorem (Theorem 1 of Section 6), Wilson's Theorem (Theorem 2 of Section 6), the formula for $d(n)$ (the stronger version of Theorem 1 of Section 7 which we proved in class), the formula for $\sigma(n)$ (the stronger version of Theorem 2 of Section 7 which we proved in class), the formula for $\phi(n)$ (which follows from Theorem 2 and Lemma 2 of Section 9), and Euler's Theorem (Theorem 1 of Section 9).
  - Even though you might not have to state them, you might need to use one of the following theorems: the primality test given by Lemma 4 of Section 2, Theorem 1 of Section 5, Theorem 5 of Section 7, Theorems 1, 2, 4 and 5 of Section 10, and Proposition 2.1, Theorem 2.2 and Theorem 3.1 of the notes on solving quadratic congruences.
  - You may be asked to give (and use!) the definition of: divisibility, the greatest common divisor (either the book definition or the one given in class), relatively prime, prime number (either the book definition or the one given in class), unit, zero divisor, inverse of a number, congruence modulo n, multiplicative function, the functions d, σ and the Euler's ϕ-function, the (multiplicative) order of an integer modulo n, and primitive root of an integer n.
  - You may be asked to explain or use the Euclidean Algorithm (Theorem 3 of Section 1).
- You should be able to compute the inverse of a number modulo n, if it exists, to solve a linear equation $ax + by = c$, to solve both one linear congruence and simultaneous linear congruences, to compute the order of an integer a modulo n if $\gcd(a, n) = 1$, and to solve quadratic congruences.
- You should expect the last problem on the exam to be a problem you have not seen before, but one you have all of the tools to solve.

You will not be given any formulae for the exam.

Note about graduate credit: There will be an extra question for graduate credit. This will count as a required part of the exam for any student taking the course for graduate credit. For anyone not taking the course for graduate credit, the assigned grade will be the maximum of the grade including the question for graduate credit and the grade not including the question for graduate credit.