Math 4400
Midterm 1 study guide

Here's a list of results you should know and things you should know how to do, organized by topic. Along with all of this stuff, you should be able to solve all the problems in Homeworks 1 through 4.

- Induction

    - Strong induction vs. Weak induction
    - The Well-ordering principle

- The Euclidean algorithm

    - The division algorithm
    - How to use the Euclidean algorithm to find $\gcd(a, b)$

- Continued fractions

    - How to find the continued fractions expansion of $\frac{a}{b}$ using the Euclidean algorithm
    - The continued fraction expansion of a number terminates if and only if that number is rational
    - How to prove a continued fraction expansion is periodic/how to compute the continued fraction expansion of a square root.

- Diophantine equations

    - The statement of Bezout's lemma
    - How to find a solution to a linear diophantine equation using the Euclidean algorithm
    - How to find all of the solutions to a linear diophantine equation given some initial solution

- Uniqueness of factorizations of the natural numbers

    - If $p \mid ab$ then $p \mid a$ or $p \mid b$
    - There are infinitely many prime numbers

- Modular arithmetic

    - Solving linear equations modulo n
    - Finding the inverse of a number modulo n
    - Fermat's little theorem
    - Euler's formula
    - Computing $\varphi(n)$
    - The Chinese Remainder Theorem
    - How to solve

$$x \equiv a \mod n$$
$$x \equiv b \mod m$$

    when $\gcd(m, n) = 1$.