Math 310 Final Exam Checklist

Below is a quick checklist of the major topics of the quarter. This should not be your only source of studying. Above all else on the final exam, I am interested to see that you understand the structure of proofs. That is, I want to see that you know where a proof should start, where it should end, and how to properly use definitions.

1. CHAPTER 1-3: Essential Definitions and Proof Techniques

- (a) Know how the logical connections 'AND', 'OR', 'NOT', and 'IMPLIES' are used and their truth values.
- (b) Know set operations (intersection, union, complement, difference) and how to prove facts about sets.
- (c) Know de'Morgan's laws.
- (d) Know direct proof, contrapositive proof, and proof by contradiction.
- (e) Know proof by induction.
- (f) Miscellaneous: Know the triangle inequality and the AGM inequality. Know what f(S) means if f is a function and S is a set. Know what it means to be bounded.
- 2. CHAPTER 4-5: Functions and binomial coefficients
 - (a) Know the definitions of well-defined, injective (one-to-one), surjective (onto) and bijective and how to give proofs for each.
 - (b) Know the definitions of decreasing, increasing, strictly monotone, nondecreasing, nonincreasing, and monotone and how to give proofs for each.
 - (c) Know how to show two sets have the same cardinality and know which of the standard sets are countable and uncoutable.
 - (d) Know what n! and $\binom{n}{k}$ represent.

(e) Know the binomial theorem, the formula for $\binom{n}{k}$, and Pascal's formula

- 3. CHAPTER 6-7: Divisibility and Congruences
 - (a) Know the meaning of a|b, gcd(a,b) = d, and $a \equiv b \pmod{n}$. Know how to use given facts about these definitions in a proof.
 - (b) Know the Division and Euclidean algorithms and how to solve for a solution to ax + by = m.
 - (c) Know what it means to be a prime and know the fundamental theorem of arithmetic.
 - (d) Know what an equivalence relation is.
 - (e) Know the properties of congruences and how you can use them to simplify certain problems quickly.
 - (f) Know what it means for a number to have a multiplicative inverse modulo n and how to determine if $ax \equiv b \pmod{n}$ has a solution $x \in \mathbb{Z}$.
 - (g) Know Fermat's Little Theorem.