## 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 $a \mid b, \operatorname{gcd}(a, b)=d$, and $a \equiv b(\bmod n)$. 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 $a x+b y=m$.
(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 $a x \equiv b(\bmod n)$ has a solution $x \in \mathbb{Z}$.
(g) Know Fermat's Little Theorem.
