Math 2001 Spring 2018 - Review

1. **Sets.**
   (1) Constructions: set builder notation, Cartesian product (1.2), subsets (1.3), power set (1.4), union, intersection, difference (1.5), complement (1.6), infinite unions and intersections (1.8)
   (2) Proving identities for sets: laws of set operations, Venn diagrams (1.7), proving $a \in A$, $A \subseteq B$, $A = B$ (see also 8.1-8.3).
2. **Logic.**
   (1) Statements: logical connectives (2.2), if (2.3), truth tables (2.5), logical equivalence (2.6), iff (2.4)
   (2) Quantifiers (2.7): negating quantified statements, checking whether quantified statement is true (proof for universally quantified statement, example for existentially quantified statement)
3. **Counting.**
   (1) Lists: with/without repetitions, permutations - factorials (3.1,, 3.2), subsets - binomials (3.3), integer solutions of $x_1 + x_2 + \cdots + x_n = k$
   (2) Binomial Theorem: Pascal's triangle (3.4)
   (3) Inclusion-Exclusion (3.5)
4. **Modular arithmetic.**
   (1) Integers: divisibility, division algorithm, gcd, lcm, extended Euclidean algorithm, Bezout's identity and coefficients, fundamental theorem of arithmetic
   (2) congruences (5.2), integers mod n (11.4)
5. **Proof methods.**
   (1) direct proof (4.2, 4.3), contrapositive proof (5), proof by contradiction (6), proof of if-and-only-if statements
   (2) induction (10)
6. **Relations and functions.**
   (1) Relations: reflexive, symmetric, antisymmetric, transitive (11.1), equivalences (11.2), classes and partitions (11.3)
   (2) Functions: injective, surjective, bijective (12.2), pigeonhole principle (12.3), composition (12.4), inverse functions (12.5)