DISCRETE MATHEMATICS
Math 245

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Suggestions for preparing for the Second Exam

I. Know how to prove the classics:

- There exist an infinite number of primes.
- $\sqrt{2}$ is irrational.
- The sum of a rational number and an irrational number is irrational.

II. Know the definitions!

- Subset. Intersection, union, set difference, complement.
- Power set, Cartesian product, partition.
- Relation, inverse of a relation, function. Injective (one-to-one), surjective (onto) and bijective functions.
- Reflexive, symmetric, antisymmetric, asymmetric, transitive.
- Equivalence relation, equivalence class.
- Partial order (poset). For posets, comparable, chain, total order, maximal, minimal, least, greatest.

III. Know your relations.

- Verify or prove that a relation R is symmetric. Know how to enlarge R to create a symmetric relation.
- Ditto for reflexive, transitive, equivalence relation, partial order.
- Know how to use tables, graphs and lists of elements to represent a relation.
- For a relation R on A, be able to find the smallest relation containing R which is symmetric (ditto for reflexive, transitive, an equivalence relation, a partial order).
- Know the standard examples of equivalence relations (mod n, 10.3 #19, 20, 22, 24, 25, 35).
- Know the standard examples of partially ordered sets: $\leq$ for the real numbers; divides on the integers; $\mathcal{P}(\mathcal{A})$ for a set A; D_n; (10.5 #18, 19, 20, 32).
- Draw Hasse diagrams for a poset. Find minimal and maximal elements of a poset.

IV. Functions as relations.

- Determine when a relation is a function, and if so, when it is injective, surjective, or bijective.
- Find the inverse relation of a function. Is it a function, injective, surjective?
- Give examples of functions satisfying various properties (7.3 #4-10).
- Use the pigeonhole principle.