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 ($\text{mod } n$, 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; $\mathcal{P}(A)$ 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.