The second test for this course will be given in class on Wednesday, October 21. It will cover mainly Chapters 5, 6, and 7. However, it is important for you to know material from earlier chapters as well. Furthermore, you should be familiar with the fundamentals of equivalence relations.

Here are some suggested practice problems. Most of these are questions that could be given on a test. A few are too long or tricky to be appropriate for a test. Unfortunately, most of the Supplementary Exercises for Chapters 5 through 8 seem to require material from Chapter 8, so only a few exercises from that set are appropriate:

- Chapter 5, p. 111, # 3, 9, 17, 2, 27, 45, 51
- Chapter 6, p. 129, # 3, 21, 23, 33
- Chapter 7, p. 145, # 7, 9, 13, 17, 27, 35
- Supplementary Exercises, p. 169, # 1, 6, 7, 8, 23, 29, 41, 49

Here are some important things you should know about, including some stuff from earlier chapters:

- gcd($a$, $b$), lcm($a$, $b$), $a \mod n$
- subgroup
- Abelian group
- the center, $Z(G)$, of a group
- Important groups: $\mathbb{Q}$, $\mathbb{Q}^+$, $\mathbb{Q}^*$, $\mathbb{Z}$, $\mathbb{Z}_n$, $U(n)$, $D_n$, $S_n$, $A_n$
- cyclic group
- A finite cyclic group of order $n$ has exactly one subgroup for each divisor of $n$.
- The number of elements of order $d$ in a finite groups is a multiple of $\varphi(d)$.
- permutation groups
- cycles
- the order of product of disjoint cycles
- Every permutation of a finite set can be written as a product of 2-cycles.
- even and odd permutations
- group isomorphisms and automorphisms
- the groups $\text{Aut}(G)$ and $\text{Inn}(G)$
- $\text{Aut}(\mathbb{Z}_n)$ is isomorphic to $U(n)$
- equivalence relations
- reflexive, symmetric, and transitive properties of a relation
- equivalence classes
- The equivalence classes of an equivalence relation on a set $X$ partition $X$.
- cosets
- left cosets ($aH$) and right cosets ($Ha$)
- $aH a^{-1}$
- If $H$ is a subgroup of $G$, the cosets $aH$ partition $G$.
- If $H$ is a subgroup of $G$, all cosets $aH$ have the same number of elements.
- Lagrange’s Theorem: If $H$ is a subgroup of a finite group $G$, $|H|$ divides $|G|$.
- If $a$ is an element of a finite group $|G|$, then $|a|$ divides $|G|$.
- Fermat’s Little Theorem: $a^p \mod p = a \mod p$, for a prime $p$ and $a \in \mathbb{Z}$.
- Every group of prime order $p$ is cyclic.
- Every group of order $2p$, where $p$ is prime, is isomorphic to $\mathbb{Z}_{2p}$ or to $D_p$. 
