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

$\gcd(a,b)$, $\mathrm{lcm}(a,b)$, $a \bmod n$
subgroup
Abelian group
the center, $Z(G)$, of a group
Important groups: $\mathbf{Q}$, $\mathbf{Q}^+$, $\mathbf{Q}^*$, $\mathbf{Z}$, $\mathbf{Z}_n$, $U(n)$, 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 $Aut(G)$ and $Inn(G)$
$Aut(\mathbf{Z}_n)$ 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)
aHa^{-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: $a^p \bmod p = a \bmod p$, for a prime p and $a \in \mathbf{Z}$.
Every group of prime order p is cyclic.
Every group of order $2p$, where p is prime, is isomorphic to $\mathbf{Z}_{2p}$ or to D_p.