Carefully study this list in conjunction with your notes and homework assignments to prepare for the exam.

**Non-proof-based Tasks:**

1. State FORMAL (including hypotheses) definitions of: $Sym(S)$, $M(S)$, $S_n$, $A_n$, $D_n$, permutation, equal functions.
2. Know that composition is associative, that composition of one-to-one functions is one-to-one, of onto functions is onto, of bijections is bijective.
3. Know that composition of rotations is a rotation, of reflections is a rotation, of one reflection and one rotation is a reflection.
4. Create full or partial (as time permits) Cayley tables for given functions, as in Section 4 HW, or for the isometries of a given geometric figure, as on HW #8(?).
5. Know the order of these groups: $S_n$, $A_n$, $D_n$.
6. Find the inverse of a given member of $S_n$.
7. Multiply cycles, including positive, negative, or 0 powers of cycles.
8. Write members of $S_n$ as products of disjoint cycles, as products of transpositions.
9. Remember that the disjoint cycle decomposition must be unique, but the transposition factorization will NOT be.
10. Formally state the Division Algorithm. Apply it to a given pair of integers.
11. Formally state my choice of 1-3 definitions of congruence mod $n$.
12. Solve basic congruences, as in 10.1-10.8.
13. Find members of a given equivalence class mod $n$; give alternative names for a given class.
14. Perform $\oplus$ or $\odot$ arithmetic in $\mathbb{Z}_n$, $\mathbb{U}_n$; find additive inverses; find multiplicative inverses when $n$ is small.
15. Know that $\oplus$ and $\odot$ are associative and commutative.
16. Find the GCD of two integers; express it as a linear combination.
17. Explain INFORMALLY whether a given set-up describes a subgroup, as on the “small” part of HW#7.
18. Recognize what the operation must be for common groups: $S$, $S^+$, and $S \setminus \{0\}$ when $S = \mathbb{Z}, \mathbb{Q}, \mathbb{R}, \mathbb{C}, M_{n \times m}(S), GL_n(\mathbb{R}), S_n, \mathbb{Z}_n, \mathbb{Z}_n^\#, \mathbb{U}_n$.

**Proof-based Tasks:**

1. Prove that $S_n$ is not abelian if $n \geq 3$.
2. Prove that if $H < G$, then the identity of $H$ equals that of $G$.
3. Prove that my choice of $\oplus, \odot$ is a well-defined operation on $\mathbb{Z}_n$.
4. Prove that $A_n < S_n$, that $U_n$ is a group.
5. Prove that a given subset is a subgroup. (Take-home)