P 1. List all 3 cycles in S_4.

P 2. Prove the following statement. Let n be a positive integer. If σ and τ are disjoint cycles in S_n then $\sigma\tau = \tau\sigma$.

P 3. Write $(123)(24)(321)$ as a product of disjoint cycles.

P 4. Write $(1234)(231)$ as a product of transpositions.

P 5. What is the order of $(123)(25)(46)$ in S_7?

P 6. Let $\sigma, \tau \in S_n$. Prove or disprove. If σ and τ are both odd then $\sigma\tau$ is even.

P 7. List the elements of A_4.

P 8. Let $\Omega = \{\{1,2\},\{1,3\},\{1,4\},\{2,3\},\{2,4\},\{3,4\}\}$. Let $\sigma = (123)$. Then S_4 acts on Ω where $\sigma \cdot \{a,b\} = \{\sigma(a),\sigma(b)\}$. Compute $\sigma \cdot \{1,4\}$ and $\sigma \cdot \{2,3\}$ where $\sigma = (123)$.

P 9. Find a subgroup of S_4 which is isomorphic to Z_4. Hint Z_4 acts on $\{0,1,2,3\}$ where $g \cdot a = g + a \bmod 4$.

P 10. Let $G = GL(n,\mathbb{R})$ and let Ω be the set of all real $n \times n$ matrices. Let $A \in G$ and $B \in \Omega$. Define $A \cdot B = BAB^{-1}$. Show that G acts on Ω.

P 11. Let G be a group such that $H \leq G$. Prove or disprove: H acts on G where $h \cdot g = gh^{-1}$.

P 12. Let $G = Z_6$. Let $H =< 3 >$ and $g = 2$. Write the elements of gHg^{-1}.

P 13. Let D_8 act on $\{1,2,3,4\}$. Let $S = \{a, ab\}$. Draw the Cayley graph.

P 14. Let D_8 act on $\{1,2,3,4\}$. Find $\text{Stab}_{D_8}(3)$.

P 15. Let S_4 act on $\{1,2,3,4\}$ defined by the action $\sigma \cdot a = \sigma(a)$. Find $\text{Stab}_{S_4}(2)$.

P 16. Let $a \sim b$ if $a, b \in \mathbb{Z}$ and $a \leq b$. Find $\text{cl}(2)$.

P 17. Let $G = S_7$. Let $H =< (23),(132) >$ act on $\Omega = [7]$ where $h \cdot a = h(a)$ for $h \in H$ and $a \in \Omega$. What are the orbits of Ω?

P 18. What are the conjugacy classes of S_4?

P 19. Let $(1432),(1324) \in S_4$. Find $\sigma \in S_4$ such that $(1432) = \sigma(1324)\sigma^{-1}$.

P 20. Let $G = S_4$ and $H =< (123) >$. List the right cosets of H in G.

P 21. Let $G = S_5$ and $H =< (12) >$. What is $|G : H|$?