## MATH 579: Combinatorics

Homework 10: Due Dec. 4

1. In $S_{6}$, set $\pi=\left(\begin{array}{llllll}1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 5 & 5 & 1 & 2\end{array}\right)$ and $\tau=\left(\begin{array}{lllllll}1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 1 & 5 & 4\end{array}\right)$. Calculate $\pi \circ \pi, \pi \circ \pi \circ \pi, \pi \circ \tau, \tau \circ \pi, \tau \circ \tau$.
2. In $S_{6}$, set $\pi=\left(\begin{array}{llllll}1 & 2 & 3 & 4 & 6 \\ 4 & 6 & 5 & 3 & 1 & 2\end{array}\right)$ and $\tau=\left(\begin{array}{llllll}1 & 2 & 3 & 4 & 5 \\ 3 & 6 & 2 & 1 & 6\end{array}\right)$. Calculate $\pi^{-1}$ and $\tau^{-1}$. Express each answer in both two-line notation and in cycle notation.
3. In $S_{6}$, set $\pi=\left(\begin{array}{llllll}1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 6 & 5 & 3 & 1 & 2\end{array}\right)$ and $\tau=\left(\begin{array}{llllll}1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 1 & 5 & 4\end{array}\right)$. Find all elements of $\langle\pi\rangle$ and $\langle\tau\rangle$.
4. In $S_{4}$, set $\gamma=(1,2,3,4)$ and $\rho=(1,3)$. Find all elements of $\langle\gamma, \rho\rangle$.
5. Find the automorphism group for:

6. Find the group of rotations for a (solid) tetrahedron, and contrast with the answer to the previous problem.
7. Find the automorphism groups for:

8. Find the automorphism group for:

9. Find the automorphism group for:

10. Find the group of rotations for a (solid) cube.
11. Find the automorphism group for:


Contrast with the answer to the previous problem.

