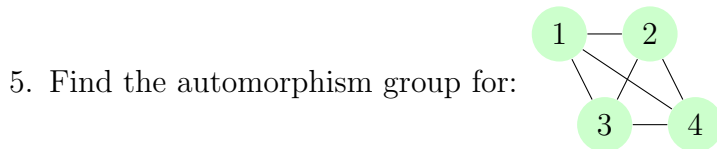
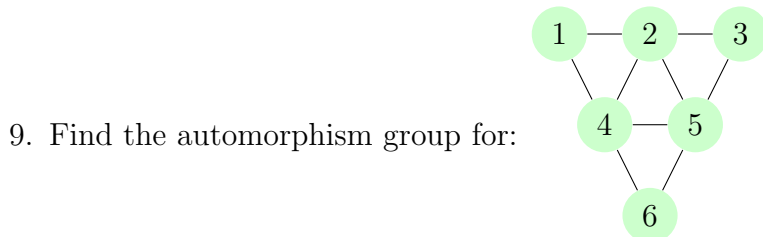
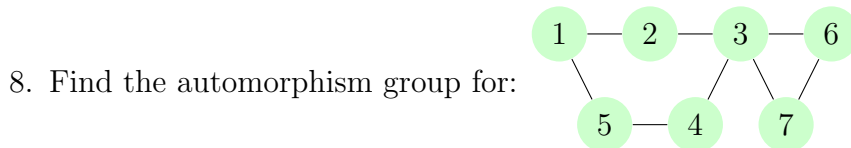
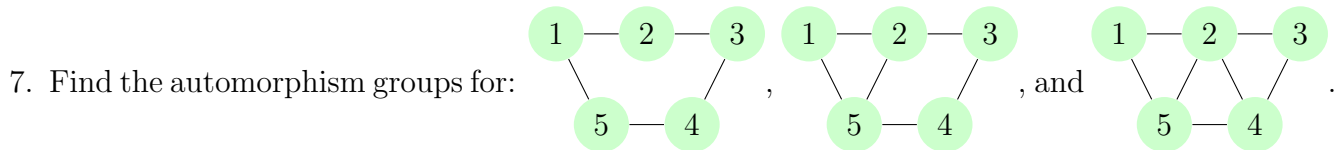


**MATH 579: Combinatorics**  
Homework 10: Due Dec.4

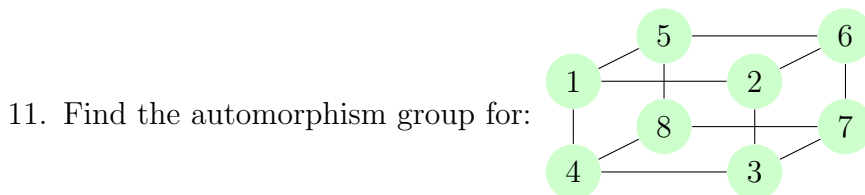
1. In  $S_6$ , set  $\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 6 & 5 & 3 & 1 & 2 \end{pmatrix}$  and  $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 1 & 5 & 4 \end{pmatrix}$ . Calculate  $\pi \circ \pi$ ,  $\pi \circ \pi \circ \pi$ ,  $\pi \circ \tau$ ,  $\tau \circ \pi$ ,  $\tau \circ \tau$ .
2. In  $S_6$ , set  $\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 6 & 5 & 3 & 1 & 2 \end{pmatrix}$  and  $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 1 & 5 & 4 \end{pmatrix}$ . Calculate  $\pi^{-1}$  and  $\tau^{-1}$ . Express each answer in both two-line notation and in cycle notation.
3. In  $S_6$ , set  $\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 6 & 5 & 3 & 1 & 2 \end{pmatrix}$  and  $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 1 & 5 & 4 \end{pmatrix}$ . 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  $\langle \gamma, \rho \rangle$ .



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



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



Contrast with the answer to the previous problem.