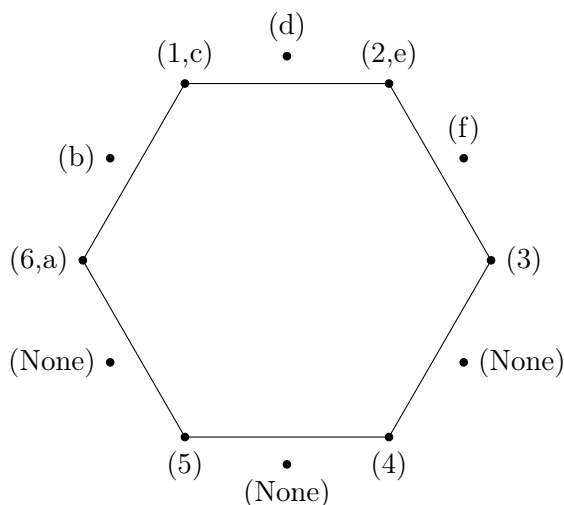


Homework 4

p77 F.1, p78 H.1, p86 A.1 (a,b,c), A.2 (b,c,d), and A.4 (d)

1. **p77 F.1.** Let G be the group of symmetries of the regular hexagon. List the elements of G (there are 12 of them), then write the table of G .



(No need to write the group table of G .)

Solution.

$$\begin{aligned}
 R_0 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix} & R_1 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 3 & 4 & 5 & 6 & 1 \end{pmatrix} & R_2 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 4 & 5 & 6 & 1 & 2 \end{pmatrix} \\
 R_3 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 1 & 2 & 3 \end{pmatrix} & R_4 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 6 & 1 & 2 & 3 & 4 \end{pmatrix} & R_5 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 1 & 2 & 3 & 4 & 5 \end{pmatrix} \\
 R_6 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 5 & 4 & 3 & 2 & 1 \end{pmatrix} & R_7 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 4 & 3 & 2 & 1 & 6 \end{pmatrix} & R_8 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 3 & 2 & 1 & 6 & 5 \end{pmatrix} \\
 R_9 &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 2 & 1 & 6 & 5 & 4 \end{pmatrix} & R_{10} &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 1 & 6 & 5 & 4 & 3 \end{pmatrix} & R_{11} &= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 6 & 5 & 4 & 3 & 2 \end{pmatrix}
 \end{aligned}$$

2. **p78 H.1.** Let A be a set of $a \in A$. Let G be the subset of S_A consisting of all the permutation F of A such that $F(a) = a$. Prove that G is a subgroup of S_A .

Solution.

3. **p86 A.1 (a,b,c).** Compute each of the following products in S_9 . (Write your answer as a singular permutation.)

Solution.

- (a) $(145)(37)(682)$
- (b) $(17)(628)(9354)$
- (c) $(71825)(36)(49)$

4. **p86 A.2 (b,c,d).** Write each of the following permutations in S_9 as a product of disjoint cycles:

Solution.

- (a) Not Assigned
- (b) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 7 & 4 & 9 & 2 & 3 & 8 & 1 & 6 & 5 \end{pmatrix}$
- (c) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 7 & 9 & 5 & 3 & 1 & 2 & 4 & 8 & 6 \end{pmatrix}$
- (d) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 9 & 8 & 7 & 4 & 3 & 6 & 5 & 1 & 2 \end{pmatrix}$

5. **p86 A.4 (d).** If $\alpha = (3714)$, $\beta = (123)$, and $\gamma = (24135)$ in S_7 , express each of the following as a product of disjoint cycles:

- (d) $\beta^2\alpha\gamma$

Solution.