

Matrix Notation
or
Array Notation

$$\alpha = \begin{bmatrix} 1 & 2 & 3 \\ \alpha(1) & \alpha(2) & \alpha(3) \end{bmatrix}$$
$$\alpha = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{bmatrix}$$

β is the another permutation of A defined as-
 $\beta(1)=3, \beta(2)=2, \beta(3)=1$

$$\therefore \beta = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

Permutation Group:

A permutation group of a set A is the set of all permutations of A that forms a group under the operation composition.

Composition of Permutations:

Let α and β be two permutations of

Set $A = \{1, 2, 3\}$ defined as

$$\alpha = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{bmatrix}, \beta = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

$$\alpha\beta = ? \quad \alpha\beta(1) = ? \quad \alpha\beta(2) = ? \quad \alpha\beta(3) = ?$$

$$\alpha\beta = \alpha \circ \beta \quad \alpha\beta(1) = \alpha\{\beta(1)\}$$

$$\alpha\beta(1) = \alpha\{\beta(1)\} = \alpha(3) = 2$$

$$\alpha\beta(2) = \alpha\{\beta(2)\} = \alpha(2) = 3$$

$$\alpha\beta(3) = \alpha\{\beta(3)\} = \alpha(1) = 1$$

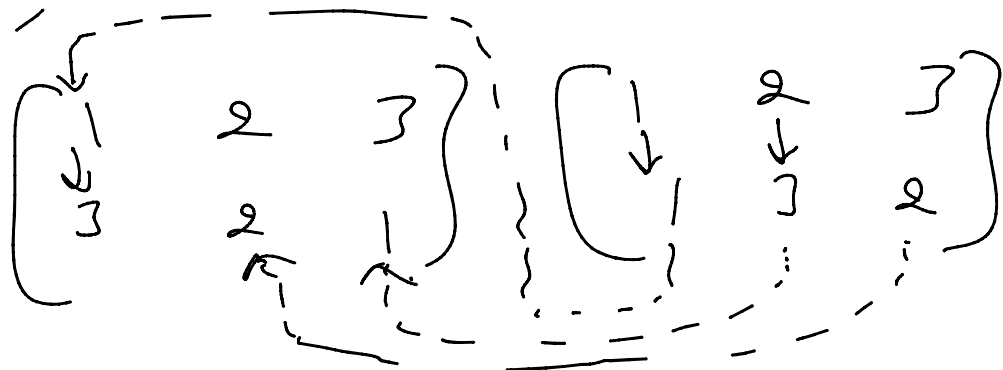
$$\therefore \alpha\beta = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$$

$$\alpha\beta = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$


$$\therefore \alpha\beta = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$$

Similarity,

$$\beta \alpha =$$



$$\Rightarrow \beta \alpha = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$$

$$\therefore \alpha \beta \neq \beta \alpha$$

$\Rightarrow$ Composition of permutations is not commutative.