

## Step-1

The definition of even and odd permutations is given below which is used to calculate even or odd transposition,

A permutation is an even permutation if it can be written as product of even number of transpositions and odd if it can be written as odd number of transpositions.

## Step-2

The objective is check whether  $+$  or  $-$  sign goes with  $a_{15}a_{24}a_{33}a_{42}a_{51}$  reverse diagonal or not in  $5$  by  $5$  matrix.

Consider an identity matrix of order  $5 \times 5$ ,

$$I_{5 \times 5} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

The  $P$  is given below,

$$P = (5, 4, 3, 2, 1)$$

It can be written as follows,

$$P = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 4 & 3 & 2 & 1 \end{pmatrix}$$

This is an even permutation.

The following matrix obtained by using even transpositions,

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

From above explanation it is clearly show that both matrices have positive sign of determinant.

Since number of transpositions is even. **Therefore,**  $a_{15}a_{24}a_{33}a_{42}a_{51}$  goes with a +ve sign in determinant of  $5 \times 5$  matrix  $(a_{ij})$ .