

- 1) $\{1, 2, 3\} \rightarrow []$ 0 inversions
 $\{1, 3, 2\} \rightarrow [32]$ 1 inversion
 $\{2, 1, 3\} \rightarrow [21]$ 1 inversion
 $\{2, 3, 1\} \rightarrow [21, 31]$ 2 inversions
 $\{3, 1, 2\} \rightarrow [31, 32]$ 2 inversions
 $\{3, 2, 1\} \rightarrow [32, 31, 21]$ 3 inversions

2) $[52, 53, 54, 74, 76] \rightarrow 5$ inversions

4) A group is a nonempty set G that has a binary operation $*$ $G \times G \rightarrow G$ that is closed under that operation, $a * b \in G$, associative $a * (b * c) = (a * b) * c$ and has an identity e such that $a * e = e * a = a$ for all $a \in G$. Also has inverse $b \in G$ for every $a \in G$ st $a * b = e$

5) $M_{2 \times 2}(\mathbb{Z})$ $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ all st $ad - bc = 1$

(i) Closure $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae+bg & af+bh \\ ce+dg & cf+dh \end{bmatrix}$
 $(ae+bg)(cf+dh) - (af+bh)(ce+dg)$
 $acef + adeh + bcfg + bdgh$
 $\hookrightarrow eh - gf = 1$