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Lemma 1

Let S_k be the number of permutations of k numbers such that no number is preserved:

$$S_k =$$

Then S_k is odd if k is even.

Lemma 2 Let M be $2k + 1 \times 2k + 1$ matrix such that

$$M_{ij} = \begin{cases} \pm 1\, if\, i \neq j \\ 0\, if\, i = j \end{cases}$$

Then for the polynomial

$$P_M(z) = \det(z + M)$$

all coefficients for odd degrees of z are not equal to zero.