invariant, ~~all the rows have~~ $\forall x \in \mathbb{N}, 0 \leq x \leq MAX\_SIZE - 2$, row x has been interchanged with column x.

• Now, what about the last row, i.e. when $x = MAX\_SIZE - 1$, ? By loop invariant, $\forall y \in \mathbb{N}, 0 \leq y \leq MAX\_SIZE - 1$, ~~row col~~ $a[MAX\_SIZE - 1][y]$ is already interchanged with $a[y][MAX\_SIZE - 1]$. There is no need to interchange the bottom rightmost element, i.e. $a[MAX\_SIZE - 1][MAX\_SIZE - 1]$.

∴ The original matrix a has been transposed in-place □

The matrix transpose function using dynamically allocated arrays has the exact same function body.