$\sigma_{(0,1)}$'s kernel is span of

$$(1,\ 1,\ 0,\ 0)\,, (0,\ 0,\ 1,\ 1)$$

$\sigma_{(0,2)}$'s kernel is span of

$$(1,\ 0,\ 0,\ 1)\,, (0,\ 1,\ 1,\ 0)$$

$\sigma_{(1,2)}$'s kernel is span of

$$(1,\ 0,\ 1,\ 0)\,, (0,\ 1,\ 0,\ 1)$$