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

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

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

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

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

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