2008 PUMaC C8

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2 Sep 2018

How many SET-preserving automorphisms are there of the SET deck?

Since the SET deck is isomorphic to $\mathbb{F}_3^4$ with SETs being equivalent to $x+y+z=0$, we are looking for the number of invertible affine transformations from $\mathbb{F}_{3^4}$ to itself, which is $3^4\left(3^4-1\right)\left(3^4-3\right)\left(3^4-3^2\right)\left(3^4-3^3\right)=\boxed{1965150720}$ as desired. ■