Itai-XKCD Question

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Let n be an integer. $D_7 = \{1256710.11984731\}$

S_n the group of permutations on $\{1 \dots n\}$

D_n the set of "Deck Permutations", the index permutation appearing in $([x,y] = xy - yx)$

$$[a_1, [a_2, [a_3, \dots [a_{n-1}, a_n] \dots]]]$$

Question What is the largest number ℓ so that S_n can be partitioned into ℓ disjoint subsets,

$$S_n = P_1 \cup P_2 \cup \dots \cup P_\ell$$

So that

$$\forall 1 \le j \le \ell \quad \forall \sigma \in S_n \ \exists \tau \in D_n \text{ s.t. } \sigma\tau^{-1} \in P_j \ ?$$

What's that Demon from Stat-Mech called? Call it X. Our question is related to

"How much of an X-demon is somebody with D_n^{-1} sorting powers".