THE RELATIONAL CLONE MEMBERSHIP PROBLEM IS HARD

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Given a finite set $R$ of relations on a finite set $D$, and another relation $s$ on $D$, the relational clone membership problem asks whether $s$ belongs to the relational clone generated by $R$ — equivalently, whether $s$ is invariant under all the polymorphisms of $R$. We prove that the space required to store a witness for a positive answer (a primitive positive definition) or a negative answer (a non-invariant polymorphism) may be required to be exponentially large in comparison to the size of the input. We also show that the problem is co-NExpTime-complete.

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