Report

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1 Inverse Reduction from $\exists\forall\exists$ 3SAT

Attempted an inverse reduction from $\exists\forall\exists$ 3SAT to $\forall\exists\forall\exists$ LP. The reduction attempt was based on the inverse reduction from 3SAT to FQLPs. Like previous attempts I could not find a way to effectively restrict existential variables in the QLP to the interval $\{0, 1\}$.

The method attempted consisted of trying to mimic the method used to restrict universal variables. Universal variables were restricted in the original reduction attempts as follows.

Instead of a single universal variable $\forall y_i \in [0, 1]$ we used a pair of variables $\forall y_i \in [0, 1]\exists z_i$ and the constraints $z_i \geq 0$, $z_i \leq 1$, $z_i \geq 2 \cdot y_i - 1$, and $z_i \leq 2 \cdot y_i$. Then z_i replaced all instances of y_i in the original constraints.

I tried to obtain a similar restriction on existential variables as follows..

Instead of a single existential variable $\exists x_i$ I used a pair of variables $\exists x_i \forall w_i \in [0, 1]$. However we cannot have constraints which restrict the universal variable further since the universal player could easily violate those constraints and thus the entire QLP. The closest we can get to the same form we constructed for universal variables is to replace each instance of x_i in the original QLP with $2 \cdot x_i - w_i$. While this has some of the properties that the original construction has there are problems associated with this. These stem from the fact that fact that while the original x_i was restricted to the range $[0, 1]$, $2 \cot x_i - w_i$ can take values outside of this range. To compensate for this it will be necessary to make further changes to the original reduction.