Canonical Logic Programs are Succinctly Incomparable with Propositional Formulas

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Canonical logic programs (CP) is essentially a propositional *non-monotonic* logic [5]. In this paper we address the question of whether CP are *succinctly incomparable* [4, 2] with *propositional formulas* (PF). Our main result shows that the PARITY problem (i.e., asking whether a binary string has odd number 1's), which can be polynomially represented in PF, *only* has exponential representations in CP. In other words, PARITY *separates* PF from CP. Simply speaking, this means that exponential size blowup is generally inevitable when translating a set of formulas in PF into an equivalent program in CP (without introducing new variables). Furthermore, since it has been shown by Lifschitz and Razborov [7] that there is also a problem which separates CP from PF (assuming $\mathsf{P} \not\subseteq \mathsf{NC}^1/\mathsf{poly}$ [8]), it follows that the two formalisms are indeed succinctly incomparable. In addition, we show that PARITY separates logic programs with *cardinality constraints* and *choice rules* (CC) [9] from CP. Moreover, assuming $\mathsf{P} \not\subseteq \mathsf{NC}^1/\mathsf{poly}$, CP and *definite causal theories* (DT) [3] are succinctly incomparable, *two-valued* programs (TV) [6] are strictly more succinct than CP and DT.

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