A recent study of symmetry breaking predicates and model counting

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Abstract. We summarize the key findings of our TACAS 2020 paper (`https://link.springer.com/chapter/10.1007/978-3-030-45190-5_7`) that presents a study of symmetry breaking predicates and model counting. The study observes the impact of different kinds of symmetry breaking predicates on the performance of state-of-the-art model counters. Specifically, we observe the performance of ApproxMC, which is the leading approximate model counter, and ProjMC, which is recently introduced exact model counter, in the context of CNF-level and domain-level symmetry breaking predicates. As benchmarks, we use a range of problems, including structurally complex specifications of software systems and constraint satisfaction problems. A key finding of the study is that the addition of symmetry breaking predicates not only impacts the model count, but also the execution time of the model counters. For example, for subjects where domain-specific, manually written, symmetry breaking predicates were available, computing the number of non-isomorphic solutions (model count of formula with given symmetry breaking predicates) was much faster than computing the number of all solutions (model count of formula with no symmetry breaking). While symmetry breaking is a heavily studied topic in general, the study provides motivation for new research on better understanding symmetries in the specific context of model counting to facilitate more effective applications of model counters.