The paper is concerned with the complexiy of proof systems for quantified Boolean formulas (QBF). The systems Q-Resolution and QU-Resolution are extensions of the classical propositional Resolution proof system, which have a similar relation to QBF solving algorithms as the latter have to SAT solving algorithms.

A characterization of the size of proofs in tree-like Q-Resolution and tree-like QU-Resolution by a Prover-Delayer game is provided, which is inspired by a similar characterization of the proof size in propositional tree-like Resolution. This gives one of the first successful transfers of a lower bound proof technique for propositional proof systems to QBF proof systems. The technique is applied to show the hardness of three families formulas for tree-like Q-Resolution. In particular, proofs of the hardness of the parity formulas of Beyersdorff et al. [1] for tree-like Q-Resolution, as well as the hardness of the formulas of Kleine Büning et al. [2] for tree-like QU-Resolution are given.

References

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