

# Maximum Satisfiability in Program Analysis: Applications and Techniques

Mayur Naik<sup>1</sup>, Xujie Si<sup>1</sup>, Xin Zhang<sup>1</sup>, and Radu Grigore<sup>2</sup>

<sup>1</sup>University of Pennsylvania      <sup>2</sup>University of Kent

**Abstract.** A central challenge in program analysis concerns balancing different competing tradeoffs. To address this challenge, we propose an approach based on the Maximum Satisfiability (MaxSAT) problem, an optimization extension of the Boolean Satisfiability (SAT) problem. We demonstrate the approach on three diverse applications that advance the state-of-the-art in balancing tradeoffs in program analysis. Enabling these applications on real-world programs necessitates solving large MaxSAT instances comprising over  $10^{30}$  clauses in a sound and optimal manner. We propose a general framework that scales to such instances by iteratively expanding a subset of clauses while providing soundness and optimality guarantees. We also present new techniques to instantiate and optimize the framework.

**Keywords:** maximum satisfiability, program analysis