

THE CALCULUS OF COMPUTATION:
Decision Procedures with
Applications to Verification

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8. Quantifier-Free Linear Arithmetic

Decision Procedures for Quantifier-free Fragments

For theory T with signature Σ and axioms Σ -formulae of form

$$\forall x_1, \dots, x_n. F[x_1, \dots, x_n]$$

Decide if

$F[x_1, \dots, x_n]$ or $\exists x_1, \dots, x_n. F[x_1, \dots, x_n]$ is T -satisfiable

[Decide if
 $F[x_1, \dots, x_n]$ or $\forall x_1, \dots, x_n. F[x_1, \dots, x_n]$ is T -valid]

where F is quantifier-free and $\text{free}(F) = \{x_1, \dots, x_n\}$

Note: no quantifier alternations

We consider only conjunctive quantifier-free Σ -formulae, i.e., conjunctions of Σ -literals (Σ -atoms or negations of Σ -atoms). For given arbitrary quantifier-free Σ -formula F , convert it into DNF Σ -formula

$$F_1 \vee \dots \vee F_k$$

where each F_i conjunctive.

F is T -satisfiable iff at least one F_i is T -satisfiable.