A Fast SAT Solver for Isabelle in Standard ML

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Abstract

This contribution contains a fast SAT solver for Isabelle written in Standard ML. By loading the theory DPT_SAT_Solver, the SAT solver installs itself (under the name “dptsat”) and certain Isabelle tools like Refute will start using it automatically. This is a port of the DPT (Decision Procedure Toolkit) SAT Solver written in OCaml.

Theory DPT_SAT_Tests tests the solver on a few hundred problems.

Contents

theory DPT_SAT_Solver
imports SAT
begin

ML_file "dpt_sat_solver.ML"

end

theory DPT_SAT_Tests
imports DPT_SAT_Solver
begin

ML {*
 val path = File.tmp_path (Path.explode "sat.out")
 val max_secs = 60

 (*
 val _ = File.write path ""
 fun write_out s = (tracing s; File.append path (s ^ "\n"))
*)
 val write_out = tracing

 fun test name =
 let
  val solver = "dptsat"
  fun aux () =
   let
    val name = "cnf/" ^ name

val timer1 = Timer.startRealTimer ()
val formula = 
  SAT_Solver.read_dimacs cnf_file
  (Path.append (Resources.master_directory @{theory}) (Path.explode name))
val timer2 = Timer.startRealTimer ()
val res = SAT_Solver.invoke_solver solver formula
val code = case res of
  SAT_Solver.SATISFIABLE _ => "SAT"
| SAT_Solver.UNSATISFIABLE _ => "UNSAT"
| SAT_Solver.UNKNOWN => "UNKNOWN"
fun show_time timer = 
  signed_string_of_int (Time.toMilliseconds (Timer.checkRealTimer timer1)) ^ "ms"
in 
  write_out (solver ^ ":" ^ name ^ ": " ^ code ^ " " ^ show_time timer2); code
end 
handle TimeLimit.TimeOut => (write_out (solver ^ ":" ^ name ^ ": TIMEOUT")); "UNKNOWN")
in 
  TimeLimit.timeLimit (Time.fromSeconds max_secs) aux ()
end 

fun sat name = (test name = "SAT" orelse error "Expected SAT")
fun unsat name = (test name = "UNSAT" orelse error "Expected UNSAT")

ML_val {* unsat "np.core.398356.cnf" *}
ML_val {* sat "np.core.398568.cnf" *}
ML_val {* unsat "np.core.398723.cnf" *}
ML_val {* unsat "np.core.398761.cnf" *}
ML_val {* unsat "np.core.398773.cnf" *}
ML_val {* unsat "np.core.398787.cnf" *}
ML_val {* unsat "np.core.398823.cnf" *}
ML_val {* unsat "np.core.398855.cnf" *}
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ML_val {* unsat "np.core.398907.cnf" *}
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ML_val {* sat "np.core.399317.cnf" *}
ML_val {* sat "np.core.399458.cnf" *}
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ML_val {* unsat "np.core.399856.cnf" *}
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ML_val {* unsat "np.core.400046.cnf" *}
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ML_val {* unsat "np.core.400219.cnf" *}
ML_val {* unsat "np.core.400351.cnf" *}
ML_val {* unsat "np.core.400353.cnf" *}
ML_val {* unsat "np.core.400474.cnf" *}

2
ML_val { * unsat "np.core.400496.cnf" * }
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ML_val { * sat "np.core.400683.cnf" * }
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ML_val { * unsat "np.core.401685.cnf" * }
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end