COMS 4995 Project Proposal: DPLL/CDCL SAT Solver

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1 Proposed Work and Methods

My project will consist of building a DPLL SAT solver [1], augmented with some enhancements offered by modern CDCL solvers [2]. The solving algorithm will be parallelized - for DPLL, I will implement a straightforward divide-at-depth-k parallel algorithm during literal assignment. The CDCL enhancements will most likely require message passing between workers to keep track of learned clauses and resolutions.

I will first implement the serial DPLL solver, then parallelize the algorithm before adding any CDCL enhancements. The specific enhancements I am targeting are clause learning and backjumping (as distinct from backtracking), which are both small pieces of the CONFLICT_ANALYSIS procedure used by modern CDCL solvers [3].

I will use a set of benchmarks encoded in DIMACS cnf format, taken from SATLIB [4] and divided by difficulty into three groups. In my evaluation, I will compare the performance of the serial and parallel versions of both the basic DPLL algorithm and the enhanced CDCL.

I will submit both a serial and parallel implementation of my ultimate solver (with flags to use DPLL or CDCL), my benchmark set, and a report describing the installation/testing procedure and evaluating the performance difference between the two implementations using my benchmark set.

2 Resources

[1] https://en.wikipedia.org/wiki/DPLL$_a lgorithm$

[2] https://en.wikipedia.org/wiki/Conflict-driven$_c lause_l earning$

[3] https://www.cs.princeton.edu/ zkincaid/courses/fall18/readings/SATHandbook-CDCL.pdf

[4] https://www.cs.ubc.ca/ hoos/SATLIB/benchm.html