Fisher Lyon

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Senior Project 1 Proposal

For the first portion of my senior project, I wish to develop a program that aims at determining whether a given boolean formula is satisfiable. In other words, I would like to develop my own SAT solver. To start, I will get reacquainted with propositional logic by referring to old course work and by completing new examples. Then, I will start with the basics; I plan on learning how to transform a boolean formula into Conjunctive Normal Form (CNF) and then develop a program that will do this for me. To follow, I will construct a brute-force SAT solver that utillizes this CNF converter. To begin, I will develop a brute-force SAT solver for boolean formulas with two boolean variables, and then I will further develop it so that it can determine satisfiablility for boolean formulas with any number of boolean variables. Having constructed a brute-force SAT solver, I'd like to move in the direction of making my SAT solver more efficient. I will do this by learning and implementing algorithms like DPLL (Davis-Putnam-Logemann-Loveland) and CDCL (Conflict Driven Clause Learning), which are used in modern SAT solvers. To conclude the work I'd like to complete during the first portion of my senior project, I'll look to other commonly used algorithms in modern SAT solvers like local search algorithms, and then implement those methods into my SAT solver.

Since the first portion consists of a lot of information absorption when it comes to SAT solvers, the second portion will consist of application. At the moment, I don't know exactly what direction I would like to go when it comes to application, but an example of a direction that I could go is using my SAT solver to develop a solution finder for given Sudoku problems. Modern day SAT solvers are mostly used in hardware and software model checking, artificial intelligence, bioinformatics, design automation, and security (cryptanalysis). Since I don't know

much about SAT solvers at the moment, while completing the first portion of my senior project, my plan is to decide the exact direction in which I would like to take my SAT solver application during the second portion of the project.