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Assignment 5 Writeup

1. What is the state space for this problem?

2^n

n = number of variables

2. Describe any implementation choices you made that you felt were important. Mention anything else we should know when evaluating your program.

My WALK-SAT implementation can solve *all* of the test files provided quickly (including aim50.cnf). However, it is slower than the DLL algorithm for large scale problems where the number of variables is far less than the number of clauses. My conjecture is that I used an array list of array lists to keep track of the formula, and iterated through this structure continuously when finding all unsatisfied clauses, positive flips, flip values, etc. Theoretically, the DLL algorithm should be slower than WALK-SAT, since it has to try every possible combination of variables. I am including this information because you mentioned in class that the purpose of the writeup is to make sure I understand what the code is doing. This is me trying to show you that I recognize that WALK-SAT should be faster, and this is my best guess to why it is not.

3. When there are around 3.3 clauses per variable, how does the target formula DLL can solve compare to the largest for your WALK-SAT?

| Algorithm | Hardest 3.3 Problem |
|-----------|----------------------------|
| DLL | 273 variables, 901 clauses |
| WALK-SAT | 250 variables, 825 clauses |

4. Repeat the process for 4.4 clauses per variable. Explain your findings.

| Algorithm | Hardest 3.3 Problem |
|-----------|----------------------------|
| DLL | 156 variables, 670 clauses |
| WALK-SAT | 75 variables, 344 clauses |

As I said above, I believe my WALK-SAT implementation is slower due to the amount of times I iterate over my formula. Theoretically, WALK-SAT should be much faster, but with the caveat that it may not ever find a solution. Additionally, if DLL returns unsatisfiable, you *know* that formula can never be satisfied. With WALK-SAT, that is not the case.

5. What suggestions do you have for improving this assignment in the future?

I have no suggestions for this assignment.