

CS4320/5314 – Artificial Intelligence

Spring 2009

Lab # 3

Satisfiability of CNF formulas

Due electronically before 11:59 p.m., Friday March 13, 2009

The purpose of this assignment is to experiment with different algorithms to determine the satisfiability of Boolean formulas in conjunctive normal form (CNF), assessing advantages and disadvantages of each.

Your task consists of the following:

1. Write a program to generate random CNF formulas. Your program should receive as parameters n , the number of variables, k , the number of literals per clause, and m , the number of clauses. Make sure your program does not generate clauses with repeated variables.
2. Experiment with the following SAT solvers, using different choices of n , k and m :
 - a) The backtracking algorithm given in class
 - b) The WalkSAT algorithm given on page 223 of the textbook
 - c) A modified backtracking algorithm where variable selection is done in an “intelligent” way, defined by your team. You may also use randomized approaches.
 - d) A modification of your genetic algorithm used to solve the travelling salesman problem.
3. Prepare a report containing the following:
 - Introduction** – Description of the problem you are trying to solve
 - Proposed solution** – How did you solve (or attempt to solve) the problem? Provide an informal, high-level description
 - Implementation** – Description of your code (not the actual code). Explain the design choices you made, data structures and programming techniques you used, your user interface, input and output, etc.
 - Experimental results** – Describe the experiments you performed to test your algorithms. The experiments must be described in a way that allows anybody to replicate them using your code.
 - Conclusions** – Explain what you learned from the project.

Work in teams of size 1 to 3. No more than one CS graduate student per team is allowed.