Rina Dechter, Spring-07

ICS 275, Assignment 6

This homeowork is based on Chapters 7 and 8.

1. (question 1, chapter 7) Consider Stochastic local search (SLS) algorithms such as GSAT and Walksat. Apply algorithm SLS to the 5-queen problem when your initial assignment is all the queens are on the diagonal. Give at most one page description of tracing the algorithm.
2. Aanalyze the complexity of SLS local search step.
3. Analayze the complexity of walksat step
4. Apply SLS to the problem in Figure 1. You can write your own code or use Rees (formulate the problem in REES and run its SLS algorithm)
5. (question 1, chapter 8) Consider the constraint network over the set of variables $\{x_1, x_2, x_3, x_4, x_5\}$, where each variable has the domains $D_i = \{$a,b,c$\}$, $1 \le i \le 5$, and the relations are given by

   $$R_{2,3,4,5} = \{ \text{(a,a,a,a), (b,a,a,a), (a,b,a,a), (a,a,b,a), (a,a,a,b)} \},$$
   $$R_{1,2,5} = \{ \text{(b,a,b), (c,b,c), (b,a,c)} \}$$

   Are the constraint relational arc and path consistent? If not makes the network relational arc and path consistent.
6. Apply DRC_2 to the graph-coloring problem in Figure 1. Show a trace of performance along ordering $x_1, ...x_7$. Show primarily what functions are recorded. Your answer should be bounded to 1 page.
7. (question 8, chapter 8) Prove that: Algorithm DLE is polynomial over the class of unary and binary inequalities of the form $x - y \le a$, $x \le b$. Prove also that the algorithm directionaly globally solves such inequalities, over the Integers (if a and b are integers), the Rationals and the Reals.
8. Consider the following cnf theory

   $$\varphi = \{(A, \neg B, D), (\neg D, F, C), (\neg C), (B, F, E), (C, F, \neg A), (\neg F, \neg A)\}$$

   1. Apply directional resolution to φ along two orderings of your choice.
   2. Is φ belong to any tractable class that you are familiar with?
   3. Apply unit-propagation to φ.
   4. Show how you find a model to φ using Directional resolution and using DPLL.
   5. Find all prime implicates of φ.

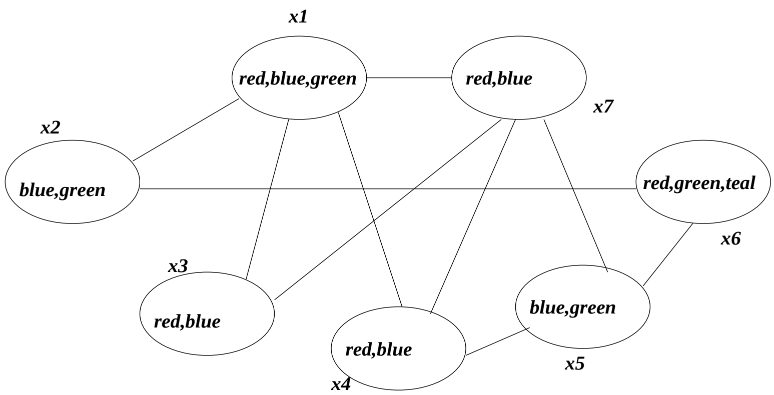

Figure 1: A modified coloring problem.

9. (question 13, chapter 8) Prove that a theory that includes all its prime implicates is globally consistent.

10. Consider the following set of linear inequalities:

$$5x_1 + x_2 + 2x_3 \leq 15$$

$$2x_2 - 7x_3 + x_4 + x_5 \leq 3$$

$$14x_3 + +x_5 - x_6 \leq 30$$

$$x_2 \geq 10, x_6 \geq 20$$

Show the execution of algorithm DLE on this theory along ordering $d_1 = x_1, x_2, x_3, x_4, x_5, x_6$ and d_2 which is the reverse order of d_1.