CS221 Fall 2014 Homework Six

SUNet ID: rolfom01
Name: Mathieu Rolfo
Collaborators: Nathan Tindall, Shalom Rottman-Yang

By turning in this assignment, I agree by the Stanford honor code and declare that all of this is my own work.

Problem 0

(a) Here is one constraint satisfaction problem that represent our lightbulb problem. (m variables and n constraints) Our variables $X_1, X_2, ..., X_m$ are the m buttons, where Domain $= \{0, 1\}$. This represents, for a proposed solution, whether the buttons have been pressed or not.The n constraints are $f_i(x) = [bulb_i = 1$ or $i \in T_j$ for some $j \notin x]$ This is equivalent to saying that for any assignment, or partial assignment, each light must either be on, or be able to be turned on by a button that hasn't been pressed yet.

(b) i: There are two consistent assignments: $\{X_1 = 0, X_2 = 1, X_3 = 0\}$ and $\{X_1 = 1, X_2 = 0, X_3 = 0\}$.
ii: If we use the fixed ordering X_1, X_2, X_3, backtrack() will be called seven times. If we use the ordering X_1, X_3, X_2, backtrack() will be called eleven times. iii: Using arc-consistency on the ordering X_1, X_2, X_3, we call backtrack() four times.

Problem 2

(a) To reduce this CSP to one with only unary constraints, introduce auxiliary variables A_1, A_2, A_3. Each auxiliary variable has a value of an input, output pair. For each auxiliary variable, we have the following constraints:
Potential 0: $[A_1(1) = 0]$
Potential 1: $[A_i(2) = A_i(1) + X_i]$
Potential 2: $[A_i(2) = A_{i+1}(1)]$
Potential 3: $[A_3(2) \leq 6]$
This scheme works because it ensures that the final value is less than six, the output value of a tuple is the input value of the successor tuple, and the output value of a tuple is the input value of the tuple, plus the value of the variable it is assisting. The domains are: $A_1 = \{(0, range(0, 2))\}, A_2 = \{(range(0, 2), range(0, 4)\}, A_3 = \{(range(0, 4), range(0, 6))\}$.

section*Problem 3

(a)

(b)

(c)

(d) Looks like I know what I'm taking this year! The scheduler worked out. I guess the best solution was picked by simple tie-breaking.