Week 3: Constraint Satisfaction (Week 2 Lecture 3)

Tutorial 5: Constraint Satisfaction (Activity 6.1: Cryptarithmetic - Open Learning)

5.1 Cryptarithmetric (Activity 6.1: Cryptarithmetic - Open Learning)

Cryptarithmetic is a type of mathematical puzzle where the numbers have been replaced with letters, or other symbols.

Solve the famous Crytarithmetric problem and Provide not just the final answer, but also explain   your reasoning along the way.

```
    S  E  N  D
 +  M  O  R  E
 _____
 M  O  N  E  Y
```

Variables:	Constraints:
D E M N O R S Y	$M \neq 0, S \neq 0$ (unary constraints)
Domains:	$Y = D + E \ or \ Y = D + E - 10$, etc.
{0,1,2,3,4,5,6,7,8,9}	$D \neq E, D \neq M, D \neq N$, etc.

a) Can you identify any backtracking heuristics or enhancements that you may have (unknowingly) used when you solved the problem?

b) Are there any backtracking heuristics or enhancements that you would now use to solve the problem more efficiently?

5.2 Map Colouring   (Activity 6.2: Forward Checking and Arc Consistency- Open Learning)
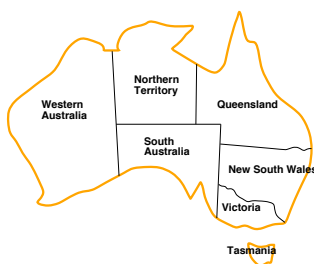

(Please refer to the activity in the third page of this week's   module, Improving Backtracking Search.)

Use Forward Checking to show that the Australia map-colouring problem has no solution when we assign WA=green, V=Red, NT=Red. If we apply Arc Consistency as well, can the inevitable failure be detected further up the tree?

Present your answer to this question and discuss with others in the tutorial group.

5.3 8-queens problem

Consider the following state for the 8-queens problem:
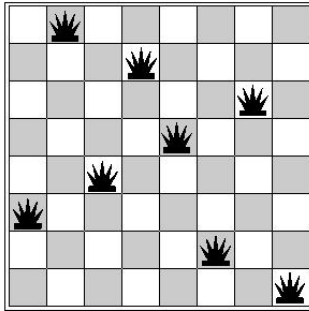
a) Is this a solution?
b) What is the value of h?
c) Explain why Hill-climbing with Min Conflicts would get stuck in this state, but Simulated Annealing may be able to "escape" and eventually find a solution.

5.4 Logic Puzzle

(Exercise 6.6 from Russell & Norvig text)

Consider the following logic puzzle: In five houses, each with a different color, live five persons of different nationalities, each of whom prefers a different brand of candy, a different drink, and a different pet. Given the following facts, the questions to answer are "Where does the zebra live, and in which house do they drink water?".

1. The Englishman lives in the red house.
2. The Spaniard owns a dog.
3. The Norwegian lives in the first house on the left.
4. The Green house is immediately to the right of the ivory house.
5. The man who eats Hershey bars lives in the house next to the man with the fox.
6. Kit Kats are eaten in the yellow house.
7. The Norwegian lives next to the blue house.
8. The Smarties eater owns snails.
9. The Snickers eater drinks orange juice.
10.The Ukranian drinks tea.
11.The Japanese eats Milky Ways.
12.Kit Kats are eaten in a house next to the house where the horse is kept.
13.Coffee is drunk in the green house.
14.Milk is drunk in the middle house.

Discuss different representations of this problem as a CSP. Why might we prefer one representation over another?