Artificial intelligence Homework3

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Problem 1

6.5

In order to explain this cryptarithmetic problem, we will solve the problem based on backtracking with forward checking and the MRV and least-constraining-value. The constrain here including: to satisfy the equation, the variables T,W,O,F,U,R can not be repeat, F can not be zero. So we can begin our algorithm as following:

- **a.** We choose value for C_3, the domain is {0,1}
- **b.**Firstly, we choose value 1 for C_3,because F can not be zero and $F = C_3$
- **c.** Since $F = C_3$, so we choose $F = 1$
- **d.**Now C_2 and C_1 are tied for minimum remaining values at 2. According to the principle of MRV. Now we choose C_2
- **e.**Since Either value will be survives forward checking and according to the principle of least-constraining-value, we can arbitrarily choose value 0 for C_2
- **f.**Now we should choose C_1, we can also arbitrarily choose 0 for value of C_1
- **g.**We now choose for O. The variable O must be an even number since $T + T\%10 = O$, So we choose 4 as the value of O.
- **h.**Variable R now has only one remaining value, which is 8

- **i.**Variable T now has only one remaining value, $\boldsymbol{T + T\%10 = O}$

- **j.** Variable U must be an even number since $\boldsymbol{W + W = U}$. we choose the value of 6 for this. Unless it will repeat with the variable of F, O and R.

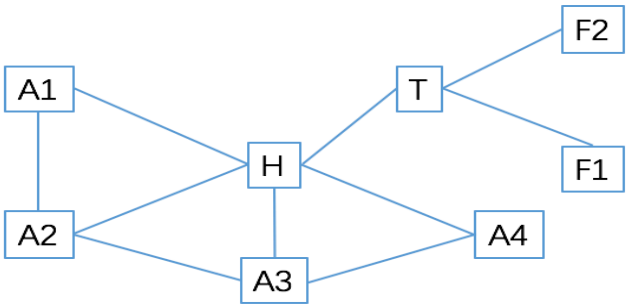
- **k.** The variable W can be choose as 3 only The over all equation can be show as:

$$\begin{array}{r} 7\ 3\ 4 \\ +\ 7\ 3\ 4 \\ \hline =1\ 4\ 6\ 8 \end{array}$$

Problem 2

6.8

The problem can be draw as following at first:



The representation of this problem by figure.

We choose the variable order as A1, H, A4, F1, A2, F2, A3, T We can set the value of $\{R, G, B\}$ The process can be explained as:

- **a.** A1 = R
- **b.** H =R, but it conflicts with A1
- **c.** H = G
- **d.** A4 = R
- **e.** F1 = R
- **f.** A2 = R, but it conflicts with A1; A2 =G, but it will conflict with H, so A2 = B
- **g.** F2 = R
- **h.** A3 has no value to choose, so we must backtrack, the conflict set is {A2, H, A4} , so we jump to A2, and add { H, A4 } to A2's conflict set
- **i.** A2 has no value to choose, so we must backtrack, the conflict set is { A1,H,A4 }, so we jump to A4
- **j.** A4 = B, F1 = R, A2 = B, F2 = R,A3 = R, T = B and we success at this step!

Problem 3

6.7

This problem can be represented as a CSP by introducing a variable for each color, pet, drink, country, and cigarette brand (a total of 25 variables). The value of each variable is a number from 1 to 5 indicating the house's number.

We can also solve this problem by Another representation is to have a tuple with five variables for each house, one with the domain of colors, one with pets, and so on.

Why we choose a representation while not another ?

We will consider two factors when choose the representation of a problem:

- It will be easy to represent all the constraints given in the problem definition.
- The efficiency of finding a solution.

Once the representation as be assured, we can choose the method of backtracking search and MRV heuristic to solve this problem.

The result

The result is zebra lives in the 5-th house, the people in the 1-st house drink water.

House	1	2	3	4	5
Color	Yellow	Blue	Red	Lvory	Green
Nationality	Norwegian	Ukrainian	Englishman	Spaniard	Japanese
Drink	**Water**	Tea	Milk	Orange juice	Coffee
Candy	Kit Kats	Smarties	Snickers	Hershey Bar	Milky ways
Pet	Fox	Horse	Snails	Dog	**Zebra**

Result of the problem