

# Artificial Intelligence, Spring 2017

## Homework 3 – CSP

Xinglu Wang 3140102282 ISEE 1403, ZJU

### 1 Problem 1

Constraints are:

- $\text{Alldiff}(F, T, U, W, R, O)$
- $O + O = R + 10C_1$
- $C_1 + W + W = U + 10C_2$
- $C_2 + T + T = O + 10C_3$
- $F = C_3$
- least-constrain-value heuristics  $\Rightarrow C_3 = 1 \Rightarrow F = 1$ , after survive forward checking we get,

F	T	U	W	R	O	$C_3$	$C_2$	$C_1$
1	0,2-9	0,2-9	0,2-9	0,2,4,6,8	2-5	1	0-1	0-1

- least-constrain-value heuristics  $\Rightarrow$  Choose  $C_2$  or  $C_3$ , choose  $C_2 = 0$ , we get,

F	T	U	W	R	O	$C_3$	$C_2$	$C_1$
1	0,2-9	0,2-9	0,2-9	0,2,4,6,8	2,4	1	0	0-1

- choose  $C_1 = 0$ , we get,

F	T	U	W	R	O	$C_3$	$C_2$	$C_1$
1	0,2-9	2,4,6,8	0,2-9	0,2,4,6,8	2,4	1	0	0

- choose  $O = 4$ , then  $T = 7, R = 8$

F	T	U	W	R	O	$C_3$	$C_2$	$C_1$
1	7	6	0,2-3,6,9	8	4	1	0	0

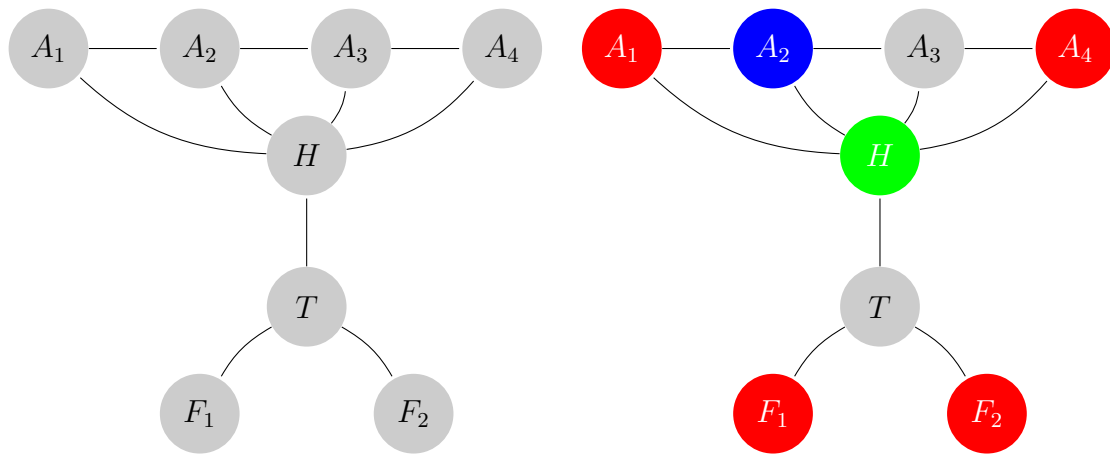
Note that  $W \neq 1 \Rightarrow U \neq 2$

- $U$  can only be 6, thus  $W = 3$ . We get the final solution:

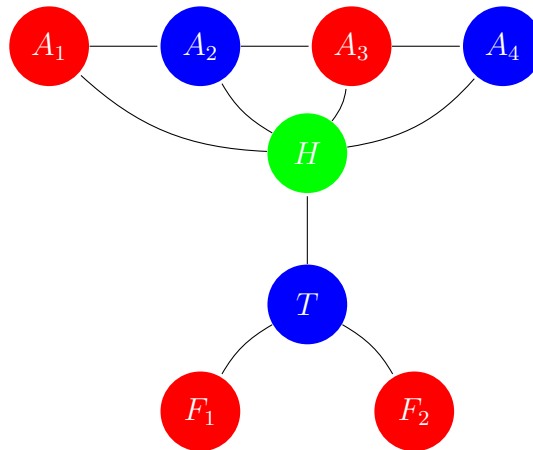
F	T	U	W	R	O	$C_3$	$C_2$	$C_1$
1	7	6	3	8	4	1	0	0

### 2 Problem 2

- Follow the order  $A_1, H, A_4, F_1, A_2, F_2$  to  $A_3, A_3$  has no color to assign.



- $A_3$  conflicts with  $\{A_2, H, A_4\}$ . Backtrack to  $A_2$
- $A_2$  conflicts with  $\{A_1, H, A_4\}$ . Backtrack to  $A_4$ , continue assign color. Finally, we get,



### 3 Problem 3

- Representation 1:  $x_i \in \{1, 2, 3, 4, 5\}, i = 1 \dots 25$  denote the position of house (left to right correspond 1 to 5).

Attribute	Red	White	...	British	...	Zebra
Belong to	$x_1$	$x_2$		$x_6$		$x_{25}$

- Representation 2:  $A_{ij}$  denote the  $j$  attribute of house  $i$ .

House	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$
1	Water	Norwegian	Yellow	Daunhill	Cat
2	Tea	Danish	Blue	Blend	Horse
3	Milk	English	Red	PallMall	Bird
4	Coffee	German	Green	Prince	Zebra
5	Beer	Swedish	White	BlueMaster	Dog

I prefer first representation. Because we can easily represent the statement in question with something like  $x_i = 1$  or  $x_i = x_j + 1$ . And just solve an linear equation system to get the solution.