CS 271 - Introduction to Artificial Intelligence **Fall 2016**

HomeWork 2

Name: *Liangjian Chen*
ID*: #52006933*

November 3, 2016

Problem 1 **Solution:**

Define cost function as how many constrains are violated. At beginning the cost is 4.

First Iteration: Assume algorithm choose assignment 1, then neighbor node list as following:

choice	cost
help	3
desk	3
easy	4
else	4
kind	4
soon	4

Algorithm chooses work help.

Second Iteration: Assume algorithm choose assignment 2, then neighbor node list as following:

choice	cost
eta	3
hat	3
her	3
him	3
one	3

Algorithm randomly chooses eta again.

Third Iteration: Assume algorithm choose assignment 3, then neighbor node list as following:

choice	cost
dance	3
usage	2
first	3
loses	3
fuels	3
haste	3
given	3
sense	3
think	3
sound	3

So, Algorithm chooses word usage.

Problem 2 **Solution:**

Variables: $\{T_i\}$ represents i^{th} class's time.
$\{I_i\}$ represents i^{th} class's instructor.
$\{R_i\}$ represents i^{th} class's classroom.

Domains: Domains of T_i is a set of possible slot time for Class i
Domains of I_i is a set of possible instructor for Class i
Domains of R_i is a set of possible classroom for Class i

Constrains: For any two class whose time slots are overlapped with each other, their classroom and instructor should be different and their.

Problem 3 **Solution:**

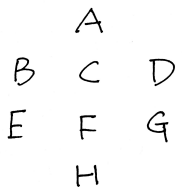
Variables: $\{(X_i, Y_i)\}$ represents coordinate of i^{th} rectangle's left upper point.

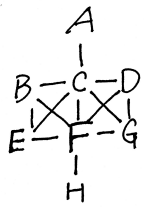
Domains: $0 \leq X_i \leq X - dX_i$
$0 \leq Y_i \leq Y - dY_i$

Constrains: assume $minX_i = X_i$, $maxX_i = X_i + dX_i$, $minY_i = Y_i$, $maxY_i = Y_i + dY_i$.
Then for any two rectangle i,j, at least one of following hold:
$max(minX_i, minX_j) > min(maxX_i, maxX_j)$
$max(minY_i, minY_j) > min(maxY_i, maxY_j)$

Problem 4 **Solution:**

(a) label the cell as following graph.





(b) Yes

(c) Yes, $A = 2$ $B = 6$ $C = 9$ $D = 5$ $E = 4$ $F = 1$ $G = 3$ $H = 8$

Problem 5 **Solution:**

(a) No, New Domain as following:
$D_2, D_3 = \{3, 4, 5, 6, 7, 8, 9\}$
$D_4, D_5, D_6, D_7 = \{5, 6, 7, 8, 9\}$
$D_8, D_9, ..., D_{15} = \{7, 8, 9\}$

(b) Yes and One solution is following:
$X_1 = 1$
$X_2, X_3 = 3$
$X_4, X_5, X_6, X_7 = 5$
$X_8, X_9, ..., X_{15} = 7$

(c) from small to large

(d) assume d is the size of domain, $O(15 * d^2) = O(d^2)$

Problem 6 **Solution:**

$$O + O = R + 10C_{10}$$
$$C_{10} + W + W = U + 10C_{100}$$
$$C_{100} + T + T = O + 10C_{100}$$
$$C_{1000} = F$$

Among variable O,R,W,T,O,U, their values are different.

Domain:
$D(F), D(C_{1000}) = \{1\}$
$D(C_{10}), D(C_{100}) = \{0, 1\}$
$D(T) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
$D(W), D(O), D(U), D(R) = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

(a) F is 1, therefore C_{1000} is 1 and eliminate 1 in other domain. and $D(T) = \{5, 6, 7, 8, 9\}$. $D(O) = \{0, 2, 4, 6, 8\}$.

(b) next MRV is C_{100}. set C_{100} is 0, $D(W) = \{2, 3, 4\}$,$D(U) = \{4, 6, 8\}$.

(c) next MRV is C_{10}. set C_{10} is 0, $D(O) = \{2, 4\}$, $D(R) = \{4, 8\}$.

(d) next MRV is $D(O)$, set $D(O) = 4$, therefore, $D(T) = \{7\}$,$D(R) = \{8\}$, $D(W) = \{3\}$, $D(U) = \{6\}$.

(e) next MRV is $D(T)$, set $D(T) = 7$.

(f) next MRV is $D(R)$, set $D(W) = 8$.

(g) next MRV is $D(W)$, set $D(W) = 3$.

(h) next MRV is $D(U)$, set $D(U) = 6$.

Find a solution which is $734 + 734 = 1468$.

Problem 7 **Solution:**

(a) variable elimination and arc consistency with domain splitting

(b) variable elimination and arc consistency with domain splitting

(c) variable elimination and arc consistency with domain splitting