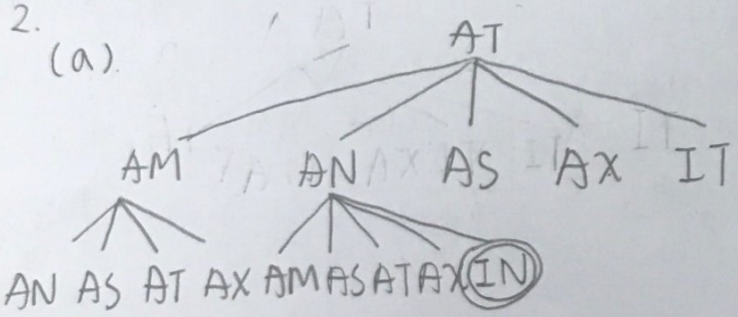
0616039 AI HW1

1. ① Robot Mouse Races:

Performance: 速度快.
Environment: 迷宮軌道
Actuators: 加速、回轉、煞車、決定向左向右轉的工具
Sensors: 偵測牆壁的感應器

② Robothespian
Performance: 會唱歌，會有動作
Environment: 公共場所、可與人溝通的地方
Actuators: 發聲工具，可以操控它四肢的工具、顯示螢幕
Sensors: 聲音感應器

2. (a)

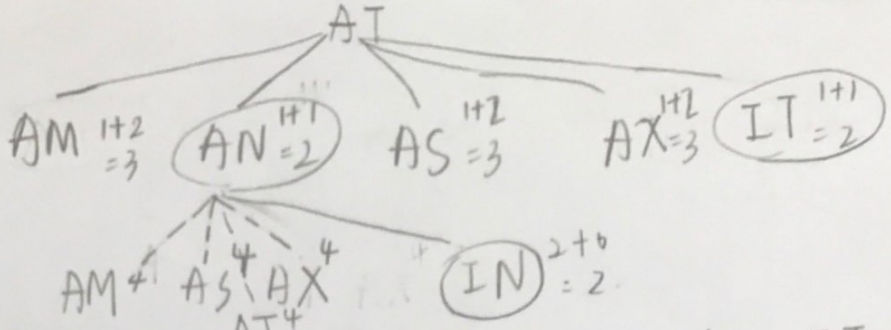


generated nodes: AT, AM, AN, AS, AX, IT, AN, AS, AT, AX, AM, AS, AT, AX, IN

expanded nodes: AT, AM, AN
solution : AT → AN → IN

(b) 因為此題為AT到IN，兩個字母皆不同，都須要改變，而兩個字母不同，至少須要2次changes，也就是n個字不同，須至少n次changes，而此heuristic，也就是n次，永遠不會超過實際上所須要的change次數，也就是cost，因此為admissible heuristic，可以低估，但不可高估。

(c)



g(n) + h(n)

IN

generated nodes: AT, AM, AN, AS, AX, IT, AM, AS, AX, IN

expanded nodes: AT, AN

solution: AT → AN → IN

3. Initial domains: $D_X = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$X = Y^2$; $X = Z^3$ $D_Y = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$D_Z = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

After checking the arc $(X \to Y)$ $D_Y = \{0, 1, 2, 3\}$

check the arc $(X \to Z)$ $D_Z = \{0, 1, 2\}$

check the arc $(Y \to X)$ $D_X = \{0, 1, 4, 9\}$, 要再檢查一次 $(X \to Z)$

check the arc $(X \to Z)$ $D_Z = \{0, 1\}$

check the arc $(Z \to X)$ $D_X = \{0, 1\}$, 要再檢查一次 $(X \to Y)$

check the arc $(X \to Y)$ $D_Y = \{0, 1\}$

no change; process terminate, so: $D_X = \{0, 1\}$, $D_Y = \{0, 1\}$, $D_Z = \{0, 1\}$

4.
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  FIVE
- FOUR
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  ONE
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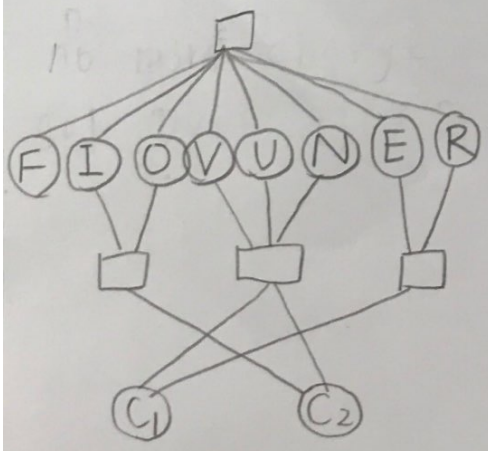
variables: $X = \{F, I, O, V, U, N, E, R, C_1, C_2\}$

Domain: $D = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Constraints:

- Alldiff(F, I, O, V, U, N, E, R)
- $F \neq 0$, $O \neq 0$
- $C_1 * 10 + E = R + E$
- $C_2 * 10 + V = U + N + C_1$
- $(\ ) * 10 + I = O + O + C_2$



domain

$D_F = D_O = \{1,2,3,4,5,6,7,8,9\} \rightarrow 9$

$D_I = D_V = D_U = D_N = D_E = D_R = \{0,1,2,3,4,5,6,7,8,9\} \rightarrow 10$

$D_{C_1} = D_{C_2} = \{0,1\}$

degree

F: 0, I: 2, O: 2, V: 4, U: 4, N: 4, E: 2, R: 2, C_1: 6, C_2: 6

① select C_1 first by MRV, assign $C_1 = 0$ by LCV (when $C_1 = 1$, $R = \emptyset$)

$D_R = \{0\}$, 其它D no change

② select R by MRV, assign $R = 0$, Remove 0 out of other's domain, 除了C_2

③ select C_2 by MRV, if $C_2 = 0$, $D_O = \{1,2,3,4\}$, $D_I = \{2,4,6,8\}$

$D_U = D_N = \{1,2,3,4,5,6,7,8\}$, $D_V = \{3,4,5,6,7,8,9\}$

if $C_2 = 1$: $D_O = \{1,2,3,4\}$, $D_I = \{3,5,7,9\}$

$D_U = D_N = \{2,3,4,5,6,7,8,9\}$, $D_V = \{1,2,3,4,5,6,7\}$

④ $C_2 = 0$, $C_2 = 1$ 會影響到的 domain 數量相同, 先 assign $C_2 = 0$.

⑤ select I by MRV, assign $I = 2$ by LCV

$D_O = \{1\}$ $D_N = D_U = \{1,3,4,5,6,7,8\}$, $D_V = \{3,4,5,6,7,8,9\}$, $D_E = D_F = \{1,3,4,5,6,7,8,9\}$

⑥ select O by MRV, assign $O = 1$,

$D_N = D_U = \{3,4,5,6\}$ $D_V = \{3,4,5,6,7,8,9\}$, $D_E = D_F = \{3,4,5,6,7,8,9\}$

⑦ select N by MRV, assign $N = 3$,

$D_U = \{4,5,6\}$, $D_V = \{7,8,9\}$, $D_E = D_F = \{4,5,6,7,8,9\}$

⑧ select U by MRV, assign $U = 4$.

$D_V = \{7\}$, $D_E = D_F = \{5,6,7,8,9\}$

⑨ select V by MRV, assing $V = 7$

$D_E = D_F = \{5,6,8,9\}$

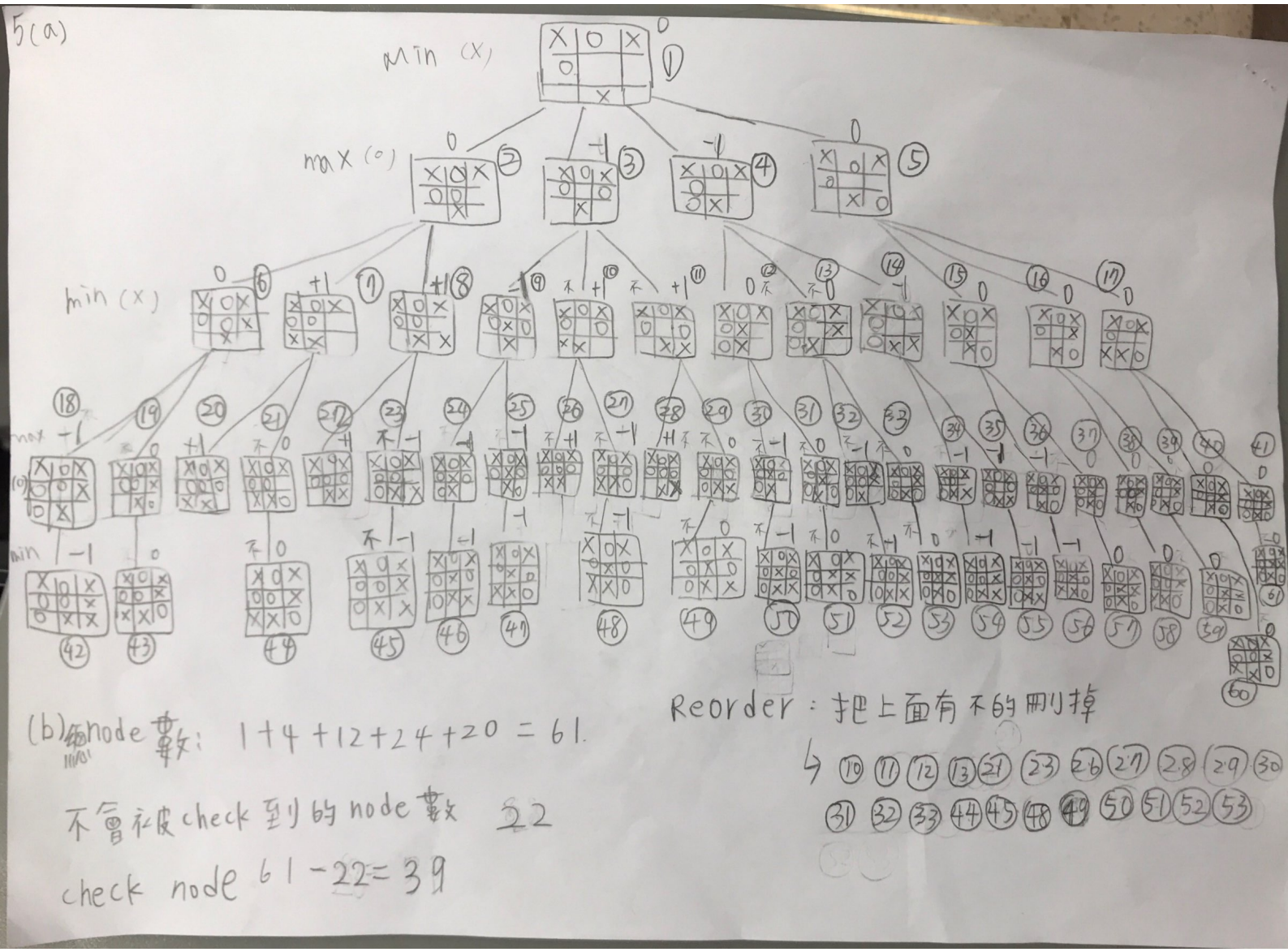
⑩ select E, assign $E = 5$, ⑪ select F, assig $F = 6$.

my solution ⇒ F=6, I=2, V=7, E=5, O=1, U=4, R=0, N=3, C_1=1, C_2=0

$$\begin{array}{r} 6275 \\ -6140 \\ \hline 135 \end{array}$$

#

5(a)



(b) node 數: 1+4+12+24+20 = 61.

不會被 check 到的 node 數 22

check node 61 - 22 = 39

Reorder：把上面有不的刪掉

↳ ⑩ ⑪ ⑫ ⑬ ㉑ ㉓ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㊹ ㊺ ㊽ ㊾ ㊿ ㊿① ㊿② ㊿③

6. (a) $[R_1]$: A

$[R_2]$: B

$[R_3]$: $P \Rightarrow Q$ convert to $\neg P \vee Q$

$[R_4]$ $L \wedge M \Rightarrow P$ convert to $\neg(L \wedge M) \vee Q \rightarrow \neg L \vee \neg M \vee Q$

$[R_5]$ $L \wedge B \Rightarrow M$ convert to $\neg L \vee \neg B \vee M$

$[R_6]$ $A \wedge B \Rightarrow L$ convert to $\neg A \vee \neg B \vee L$

$[R_7]$ $A \wedge P \Rightarrow L$ convert to $\neg A \vee \neg P \vee L$

(b) $[R_8$ = 假設 $]$ $\neg Q$ (先設Q為false)

$[R_9 : R_1 + R_6]$ $\neg B \vee L$

$[R_{10}$ $R_2 + R_9]$ L

$[R_{11} = R_2 + R_5]$ $\neg L \vee M$

$[R_{12} : R_{10} + R_{11}]$ M

$[R_{13} : R_4 + R_{10}]$ $\neg M \vee Q$

$[R_{14} : R_4 + R_{13}]$ Q

$[R_{15}$: R_8 與 R_{14} 矛盾$]$ false $\Rightarrow$ 矛盾 $\Rightarrow$ Q is true