Artificial intelligent 第十名.

1. ◦ Robot Mouse Races.

Performace = destination, time.

Enviroment = 迷宮內有很多牆、死路.

Actuators = Steering, accelerator. 記錄路徑.

Sensors = 感應牆壁(死路), accelerometer.

◦ Robot hespian

Performance = comfort, 溝通, 情感表達.

Environment = public environment.

Actuators = speaker. Mic. Camera.

Sensors = emotion, GPS, eye contact.

2. AT → IN

a. #BFS

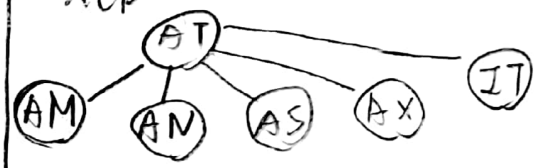
step 0

(AT)

generated node = (AT)

Explored =

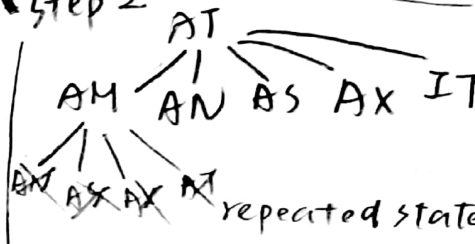
step 1.



AT, AM, AN, AS, AX, IT

AT.

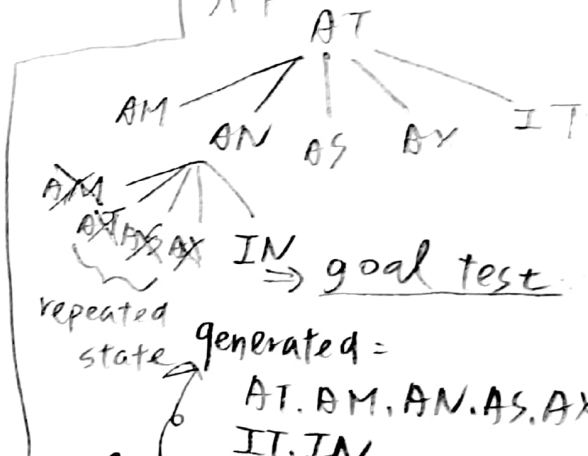
step 2



AT, AM, AN, AS, AX, IT

AT, AM

step 3.



b. 使用 hamming distance 可以去識差異最小的字先去 expand. 而不是差異很大的字. ex. 上面的例子中 AM 就沒有必要去 expand. 因為明明 AM 跟 IN 的差異是 2, AN 跟 IN 的差異是 1. 要是 AM 前面有很多字 ex. AA. AB. AC. AD... ⇒ 不必要的字去 expand. 而且規則是字一次只能換 1 個 所以 heuristic 也不會高估 cost.

4.

(c) *A* $f = h + g$ h: 字數不同. g: 換幾次字

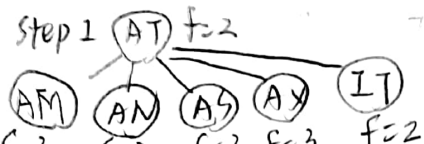
Step 0

(AT) f=2

generated: AT

explored:

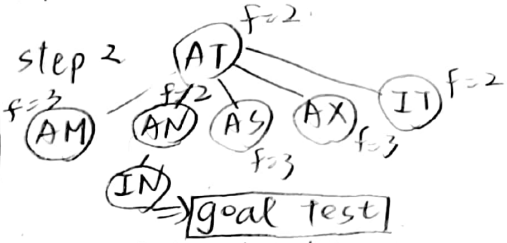
Step 1



AT. AM. AN. AS. AX. IT

AT

step 2



AT. AM. AN. AS. AX. IT. IN

AT. AN

3.

- $X = Y^2$ arc set = $X \to Y$. $Y \to X$. $X \to Z$. $Z \to X$
- $X = Z^3$

Initial state:

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

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

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

① After checking ($X \to Y$)

$D_X = \{0, 1, 4, 9\}$ ↓ D_X changed.

② neighbor. arc($Y \to X$)

$D_Y = \{0, 1, 2, 3\}$

③ Next, check ($X \to Z$)

$D_Y = \{0, 1\}$ ↓ D_X changed.

④ neighbor Y

$D_Y = \{0, 1\}$

⑤ check ($Z \to X$)

$D_Z = \{0, 1\}$

⑥ no changed in all arcs.

$D_X = \{0, 1\}$. $D_Y = \{0, 1\}$. $D_Z = \{0, 1\}$.

4. C_2 / $V-C_1$ / $I-C_2$ C_1

FIVE

−FOUR

ONE

① $E+10*C_1-R=E$ ← Constraint

② $V-C_1+10*C_2-U=N$

③ $I-C_2-O=0$

④ $F.O>0$

⑤ alldiff(FIVEOUR.N)

Variable: F, I, V, E, O, U, R, N, C_1, C_2

Domain: {0,1,2,3,4,5,6,7,8,9.} for F, I, V, E, O, U, R, N

{0,1} for C_1, C_2.

⑥.

$10*C_1=R$

$V-C_1+10*C_2-U=N$

$I-C_2-O=0 \Rightarrow I-C_2=20$ 約束的最大數

$F.O>0$

alldiff(FIVEOURN)

tep 1

MRV (fewest legal values): $C_1(2)$, $C_2(2)$, R(2) F(9), O(9) → 選R

IVEUN(10)

Degree (most constraints): $C_1(2)$, $C_2(2)$ R, V, U, N, I, O F(8) E(7)

LCV (least constraining value): R=1時 $C_1=10$ domain不符合 ⇒ 選 $R=0$, $C_1=0$

forward: D_R {0} D_{C_1} {0} R_{C_2} {0,1} $D_{FIVEOUN}$ {1~9}

Step 2.

MRV: $C_2(2)$ FIVEOUN(9) → 選C_2

Degree: $C_2(2)$ FIVOUN(7), E(6)

LCV: $C_2=0$. $I=20$ $D_O=\{1,2,3,4\}$ $D_I=\{2,4,6,8\}$

$V-U=N$ $D_{V,N}$ {1~8} $D_V=\{3\sim9\}$ → the same, choose $C_2=0$

$C_2=1$ $I=20+1$ $D_O=\{1,2,3,4\}$ $D_I=\{3,5,7,9\}$

$V+10-U=N+U$ $D_V=\{1\sim7\}$ $D_{N,U}$ {2~9}

19×18×17

↓

step3 $C_2=0, C_1=0, R=0$

MRV = O(4), I(4) U,N(8) V(7), F,E(9) } choose O.

Degree = FIVOUN(7). E(6)

LCV = O=1. I=2 V-U=N $D_V=\{7\sim9\}$. $D_{U,N}=\{3\sim6\}$.

forward O=2 I=4 $D_{U,N}=\{1,3,5,6,7,8\}$ $D_V=\{4,6,7,8,9\}$

O=3 I=6 $D_{U,N}=\{1,2,4,5,7,8\}$ $D_V=\{3,5,6,8,9\}$

O=4 I=8 $D_{U,N}=\{1,2,3,5,6,7\}$ $D_V=\{3,4,5,6,7,8\}$

⇒ choose O=1, I=2

Step 4. $C_2=0, C_1=0, R=0$. O=1. I=2.

MRV = U,N(4) V(3), FE(7) } choose V.

Degree : FV,U,N(5), E(4)

LCV = V=7. $D_{U,N}=\{3,4\}$

V=8. $D_{U,N}=\{3,5\}$.

V=9 $D_{U,N}=\{3,4,5,6\}$

⇒ choose V=7, $D_{U,N}=\{3,4\}$.

Step 5. $C_2=0, C_1=0, R=0$. O=1, I=2, V=7.

MRV = U,N(2), FE(6) } choose U

Degree = F,U,N(4), E(3)

LCV. U=3 N=4 $D_F=\{5,6,8,9\}$ $D_E=\{5,6,8,9\}$.

U=4. N=3. 〃 〃

⇒ choose U=3, N=4.

Step 6 = $C_2=0, C_1=0, R=0$, O=1, I=2, U=3, N=4, V=7.

MRV = FE(4) ⇒ choose F

Degree = FE(1)

LCV = ① F=5. $D_E=\{6,8,9\}$ ② F=6. $D_E=\{5,8,9\}$ ③ F=8, $D_E=\{5,6,9\}$ ④ F=9 $D_E=\{5,6,8\}$

⇒ choose

Step 6 C

assign

5

−5

5. (a)

MIN(X)

Ax(0)

MIN(X)

0 1

1

0

−1

3) choose F=5.

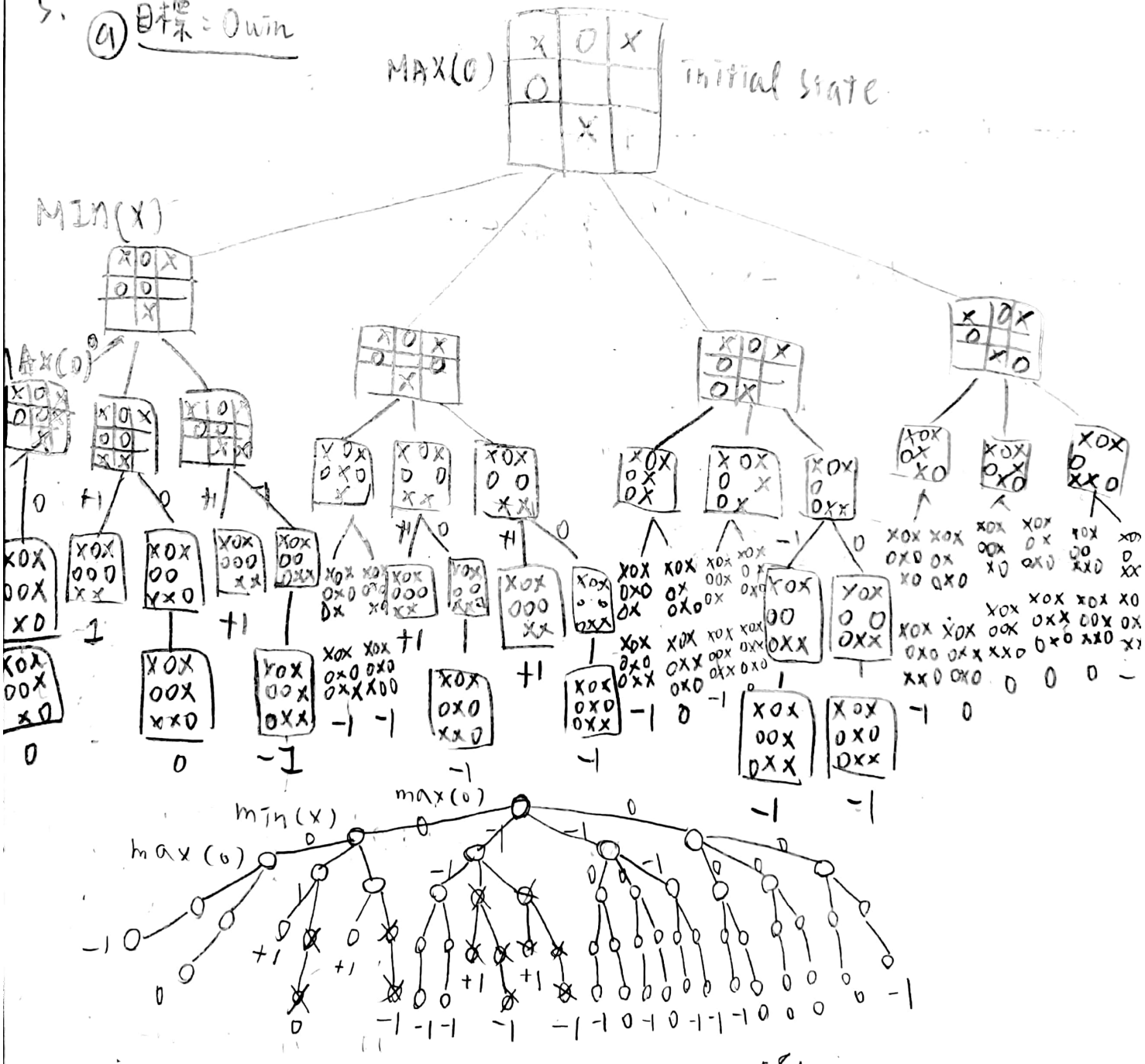
U=3 N=4

step 6. $C_2=0$. $C_1=0$. R=0. O=1. I=2. F=5 V=7.

assign. E=5 ⇒ find solution

$$\begin{array}{r} 5275 \\ -5130 \\ \hline 145 \end{array}$$

5. (a) 目標: O win



48.

minimax without α-β = 4*3*2 = 24*2+12+4-4 = 60

with α-β = = 60-12 = 48 葉

6.

(a)

	CNF	A, B,
$P \Rightarrow Q$	$\neg P \vee Q$	
$L \wedge M \Rightarrow P$	$\neg(L \wedge M) \vee P$	$\neg L \vee \neg M \vee P$
$L \wedge B \Rightarrow M$	$\neg(L \wedge B) \vee M$	$\neg L \vee \neg B \vee M$
$A \wedge B \Rightarrow L$	$\neg(A \wedge B) \vee L$	$\neg A \vee \neg B \vee L$
$A \wedge P \Rightarrow L$	$\neg(A \wedge P) \vee L$	$\neg A \vee \neg P \vee L$

(b)

prove $(KB \wedge \neg Q)$ is unsatisfiable (always false)

A | B | $\neg P \vee Q$ | $\neg L \vee \neg M \vee P$ | $\neg L \vee \neg B \vee M$ | $\neg A \vee \neg B \vee L$ | $\neg A \vee \neg P \vee L$

$A \vee \neg A \vee \neg P \vee L \equiv \neg P \vee L$.

$A \vee \neg A \vee \neg B \vee L \equiv \neg B \vee L$

$(\neg B \vee L) \vee B \equiv L$

$(\neg L \vee \neg B \vee M) \vee B \vee L = M$

$(\neg L \vee \neg M \vee P) \vee L \vee M = P$

$\neg Q \vee (\neg P \vee Q) \equiv \neg P$

P	Q	result
T	T	T
T	F	T
F	T	T
F	F	T

L	M	P	result
T	T	T	T
F	T	T	T
T	F	T	T
F	F	T	T
T	T	F	F
F	T	F	T
T	F	F	T
F	F	F	T

empty !

unsatisfiable

$\therefore$ KB entails Q