

(1) Robot Mouse Race

Performance measure: destination, time, efficient, rate, error

Environment: the maze, start, end

Actuators: accelerator, brake, display

Sensors: accelerometers, motor sensors, Direction sensors

(2) Robothespian

P: telling language, movement, Grammar, correctness

E: space

A: horn, speaker, display, machine about robot body, translator

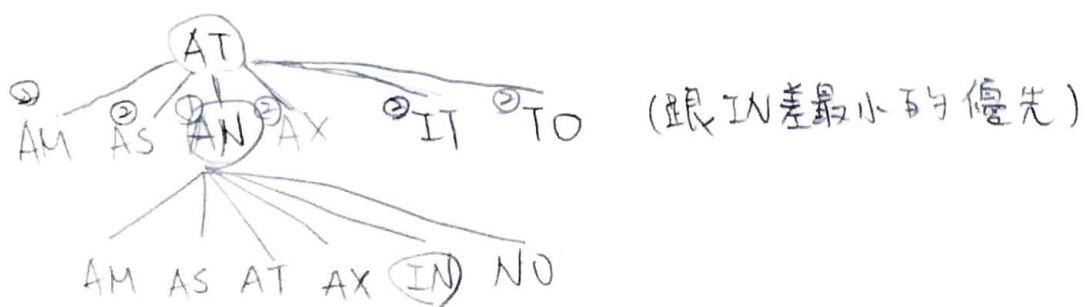
S: video, hearing sensor, space sensor

(a) {AT, AM, AS, AX, IT, IN}

(b) hamming distance 代表 2 單詞 具不同字母的位置

而假如相差一字母最少也需要一次搜尋 還是在第一次就找到的情況下, 而 2 個字母在 BFS 中也要先找完一個字母的差異才往下找, 所以永遠不會高估, \therefore admissible heuristic

(c)



3. $X = Y^2$ $X = Z^3$

$$X \rightarrow Y \quad D_x = \{0, 1, 4, 9\} \quad D_y = \{0, 1, 2, 3\}$$

$$X \rightarrow Z \quad D_X = \{0, 1, 8\} \quad D_Z = \{0, 1, 2\}$$

$$X \rightarrow Y, z \quad D_x = \{0, 1\} \Rightarrow D_y = \{0, 1\}, D_z = \{0, 1\}$$

Coh

4. ~~FIVE~~
- FOUR

ONE

Variables = F, I, V, E, O, U, R, N,

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

Constraint : If ($t > 0$)

Back track in 9

$$\text{allDiff}(\{F, I, V, E, O, U, R, N\})$$

$F - F = 0$ 不用看

$$\begin{array}{l} E > R \\ E - R = E \end{array} \quad R = 0 \quad \text{or} \quad \begin{array}{l} E < R \\ 10 + E - R = E \end{array} \quad R = 10, \text{ impossible}$$

$$V - U = N \quad \text{or} \quad 10 + V - U = N$$

$$I - 0 = 0, I = 20$$

$$\begin{array}{r} \text{FIVE} \\ + \text{ONE} \\ \hline \end{array}$$

$$\begin{array}{r} \text{FOUR} \\ + \text{ONE} \\ \hline \text{FIVE} \end{array}$$

$$\begin{aligned} \rightarrow F &> 0 \\ C_1, C_3 &= 0 \\ R &= 0 \end{aligned}$$

$$C_2 = 0$$

$$\Rightarrow 0 = 0 \rightarrow I = 0 \text{ but } 0 \neq I, \text{ back}$$

$$\Rightarrow 0=1 \rightarrow \mathbb{Z} \neq \mathbb{Z} = \mathbb{I} = 2$$

$$\rightarrow U + N + 0 \cdot 10 = \frac{V}{5}$$

$$\begin{array}{c} 1 \quad 3 \end{array}$$

$$U + N = \frac{V}{5}$$

$$\begin{array}{c} 3 \quad 5 \quad 8 \end{array}$$

$F = \text{著者數} = 4$

$$E = \text{任意数} = 6$$

7130

$$\begin{array}{r} \text{FOUR FIVE} \\ 4256 \\ + 136 \text{ ONE} \\ \hline 4120 \text{ FOUR} \end{array}$$

$$\begin{array}{r} \text{FIVE} \\ - \text{FOUR} \\ \hline 136 \end{array}$$

$$\begin{array}{r} \text{FIVE} \\ - \text{FOUR} \\ \hline \text{ONE} \end{array}$$

\Rightarrow

$$\begin{array}{r} \text{FOUR} \\ + \text{ONE} \\ \hline \text{FIVE} \end{array}$$

Variable: F, O, U, R, N, E, I, V
C₁, C₂, C₃

除 C₁, C₂, C₃ Domain {0, 1}
其它 {0 ~ 9}

(a) constraints

all different (F, O, U, R, N, E, I, V)

$$F > 0$$

$$R + E = E + 10 \times C_1$$

$$U + N + C_1 = V + 10 \times C_2 \quad \Rightarrow$$

$$O + O + C_2 = I + 10 \times C_3$$

$$F + C_3 = F$$

$$F > 0$$

$$\boxed{R = 0} \quad 0 + E = E, \quad C_1 = 0$$

$$U + N = V + 10 \times C_2$$

$$O + O + C_2 = I$$

$$F + 0 = F$$

$$C_1 = 0, \quad C_3 = 0$$

剩下 Domain {1 ~ 9} !! R = 0

(b) $C_2 = 0 \quad \text{or} \quad C_2 = 1$

[

$$O + O = I$$

\rightarrow 若 O = 1, 则 I = 2 Domain {3 ~ 9}

$$\rightarrow U + N = V$$

设 U = 3, N = 4, 则 V = 7

$$\rightarrow F = 5 \quad (\text{or } 6, 8, 9)$$

$$\rightarrow E = 6 \quad (\text{or } 8, 9)$$

得解: F = 5, O = 1, U = 3, R = 0, N = 4, E = 6, I = 2, V = 7

$$\begin{array}{r} \text{FIVE} \\ - \text{FOUR} \\ \hline \text{ONE} \end{array}$$

\Rightarrow

$$\begin{array}{r} 5276 \\ - 5130 \\ \hline 146 \end{array}$$

#

X	O	X
O		
	X	

MAX

O win = -1

X win = 1

平手 = 0

X	O	X
O		
O	X	

MIN

0

X	O	X
O	X	
O	X	

MAX

0

X	O	X
O		X
O	X	

1

X	O	X
O		
O	X	X

1

X	O	X
O	X	
O	X	O

MIN

0

X	O	X
O	X	O
O	X	

0

X	O	X
O	O	X
O	X	

1

X	O	X
O		X
O	X	O

0

X	O	X
O	O	
O	X	X

1

X	O	X
O		O
O	X	X

1

X	O	X
O	X	X
O	X	O

MAX

0

X	O	X
O	X	O
O	X	X

0

X	O	X
O	O	X
O	X	X

1

X	O	X
O	X	X
O	X	O

0

X	O	X
O	O	X
O	X	X

1

X	O	X
O	X	O
O	X	X

1

X	O	X
O	O	
	X	

0

X	O	X
O	O	
X	X	

0

X	O	X
O	O	
X	X	O

0

X	O	X
O	O	X
X	X	O

0

X	O	X
O	O	O
X	X	

-1

X	O	X
O	O	X
	X	

1

X	O	X
O	O	X
O	X	

1

X	O	X
O	O	X
	X	O

0

X	O	X
O	O	X
O	X	X

1

X	O	X
O	O	X
X	X	O

0

X	O	X
O	O	
	X	X

1

X	O	X
O	O	O
	X	X

0

X	O	X
O	O	
O	X	X

1

X	O	X
O	O	X
O	X	X

X	O	X
O		O
	X	

1

X	O	X
O		O
X	X	

1

X	O	X
O	X	O
	X	

1

X	O	X
O		O
	X	X

1

X	O	X
O	O	O
X	X	

0

X	O	X
O		O
X	X	O

1

X	O	X
O	X	O
O	X	

1

X	O	X
O	X	O
	X	O

1

X	O	X
O	O	O
	X	X

-1

X	O	X
O		O
O	X	X

1

X	O	X
O		
	X	O

6

X	O	X
O		
X	X	O

0

X	O	X
O	X	
	X	O

1

X	O	X
O		X
	X	O

0

X	O	X
O	O	
X	X	O

0

X	O	X
O	O	O
X	X	

-1

X	O	X
O	X	
O	X	O

0

X	O	X
O	X	O
	X	O

1

X	O	X
O		X
O	X	O

1

X	O	X
O	O	X
	X	O

0

X	O	X
O	O	X
X	X	O

0

X	O	X
O	X	X
O	X	O

0

X	O	X
O	X	O
X	X	O

1

X	O	X
O	X	X
O	X	O

0

X	O	X
O	O	X
X	X	O

6

6. Convert into CNF

(a) A, B

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

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

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

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

$$(\neg A \vee \neg P \vee L)$$

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

$$\wedge (\neg A \vee \neg B \vee L) \wedge (\neg A \vee \neg P \vee L)$$

(b) $A, B, (\neg A \vee \neg B \vee L)$

L

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

M

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

P

\Rightarrow

$$\frac{P, (\neg P \vee Q)}{Q} \quad (P \wedge \neg P) = \emptyset$$