Name: YANG, Ke SID: 20945880 itsc: hyang62 @connect.ust.hk.

P1

2.1.1

Start State

1 2 3
8 4 0
7 6 5

→

Goal State:

1 2 3
8 0 4
7 6 5

$P(n) = 1$

$S(n) = 2 + 1 = 3$ $\therefore h(n) = P(n) + 3S(n) = 10$

path-length = 1, $f^*(n) = 1$

$\therefore h(n) > f^*(n) \Rightarrow$ overestimated.

$\therefore$ Nilsson is not admissible.

2.2

Running result:

	Puzzle 1	Puzzle 2	Puzzle 3
h1: Misplaced tiles	18 moves, 1747 expanded nodes	18 moves, 1124 expanded nodes	20 moves, 2852 expanded nodes
h2: Manhattan distance	18 moves, 227 expanded nodes	18 moves, 80 expanded nodes	20 moves, 152 expanded nodes
h3: Nilsson	N/A	N/A	N/A
h4: Mostow and Prieditis	18 moves, 522 expanded nodes	18 moves, 264 expanded nodes	20 moves, 680 expanded nodes

Puzzle 4	Puzzle 5
14 moves, 207 expanded nodes	7 moves, 12 expanded nodes
14 moves, 32 expanded nodes	7 moves, 8 expanded nodes
N/A	7 moves, 8 expanded nodes
14 moves, 67 expanded nodes	7 moves, 8 expanded nodes

① Nilsson is not giving the optimal solution, and thus it is not admissible

② $h_2 > h_4 > h_1$

Manhattan: most efficient, Misplaced tiles least efficient.

P2

Step 1 :

$$\begin{cases} O+O=R+10*C_1 \\ C_1+W+W=U+10*C_2 \\ C_2+T+T=O+10*C_3 \\ F=C_3 \end{cases}$$

F. T. W. U. R. O all have different value in $\{0,\cdots 9\}$

$C_1, C_2, C_3 \in \{0,1\}$

$F \neq 0$. $T \neq 0$.

Step 2.

$F=C_3 \in \{0,1\}$, $F\neq 0$ $\therefore F=1$

$\therefore U, W, R, O \in \{0,2,3,\cdots 9\}$

$T \in \{2,3,\cdots 9\}$

MRV $\Rightarrow$ Assign value to T =

$C_2+2T=O+10 \Rightarrow O=C_2+2T-10$, $C_2 \in \{0,1\}$ $\therefore T>4$

$T=5$, $O=0$

$T=\{6,7,8\}$, O have two possible values.

$\therefore$ LCV $\Rightarrow T=6$

$\therefore C_2+12=O+10$ $\therefore O=C_2+2$ $\therefore O\in\{2,3\}$

$O=2$, $C_2=0$

$\therefore \begin{cases} C_1+2W=U \\ R+10C_1=4 \end{cases} \Rightarrow R=4-10C_1$ $\therefore R=4, C_1=0$ (C_1 cannot be 1)

$\therefore 2W=U$

$\therefore$ Domain of U is remaining even value $\{0,8\}$

$U=0 \Rightarrow W=0$ Contradict (×)

$U=8 \Rightarrow W=4$ Contradict with $R=4$ (×)

Backtrack to $O=3$

$\begin{cases} C_1+2W=U+10 \\ R+10C_1=6 \end{cases} \Rightarrow R=6, C_1=0$ (Contradict with $T=6$)

Set T=7

$C_2+14 = O+10 \Rightarrow O = C_2+4$ $\therefore O = \{4,5\}$

Set $O=4$, $C_2=0$

$\begin{cases} C_1+2W=U \\ 8=R+10C_1 \Rightarrow R=8,\ C_1=0 \end{cases}$

$\therefore 2W=U$

$\therefore$ Domain of U : $\{0,2,6\}$

Using LCV : $U=6$, $W=3$ (only one possible value)

$\therefore T=7,\ O=4,\ R=8,\ U=6,\ W=3,\ F=1$