Lab-4

8/09/25

Apply A* Algorithm

Misplaced Tiles

Manhattan Distance

2	8	3
1	6	4
7		5

I

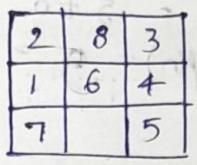
1	2	3
8		4
7	6	5

F

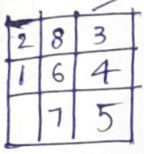
$f(n) = g(n) + h(n)$

= Misplaced Tiles

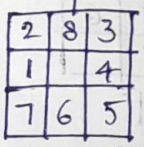
solution



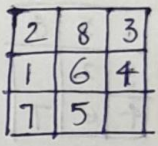
g=0



H·V = 6+1 = 7

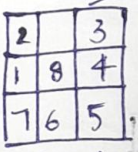


H·V = 3+1 = 4

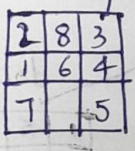


H·V = 6+1 = 7

g=1

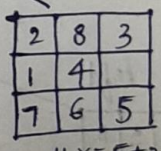


H·V = 4+2 = 6



H·V = 5+2 = 7

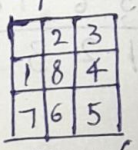
H·V = 4+2 = 6



H·V = 5+2 = 7

g=2

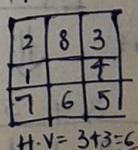
H·V = 3+3 = 6



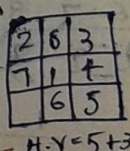
H·V = 2+3 = 6

H·V = 5+3 = 8

H·V = 4+3 = 7



H·V = 3+3 = 6



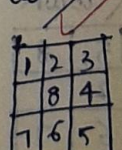
H·V = 5+3 = 8

g=3

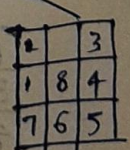
H·V = 5+4 = 9

H·V = 4+4 = 8

H·V = 5+4 = 9



H·V = 2+4 = 6



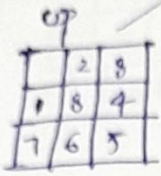
H·V = 4+4 = 8

H·V = 4+4 = 8

H·V = 5+4 = 9

H·V = 5+4 = 9

H.V = 2+4 = 6



H.V = 2+5 = 7

4+5 = 9

3+5 = 7

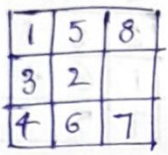
= 0+5 = 5

$f(n) = g(n) + h(n)$

$= 5 + 0$

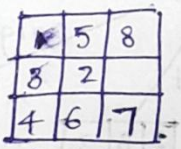
$f(n) = 5$

Manhattan distance



Initial

goal



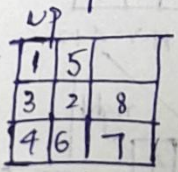
= 0

left

1 2 3 4 5 6 7 8

0 2 3 1 1 2 2 3 = 14

up



down

= 1

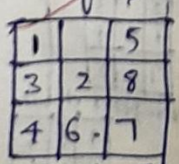
1 2 3 4 5 6 7 8

0 1 3 1 1 2 3 3 = 14

1 2 3 4 5 6 7 8

0 1 3 1 1 2 2 2 = 12

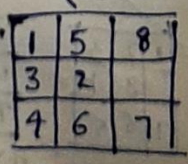
left



1 2 3 4 5 6 7 8

0 1 3 1 1 2 2 2 = 13

down



= 2

1 2 3 4 5 6 7 8

0 1 3 1 1 2 2 3 = 13

Algorithm for (Misplaced Tiles)

1. Start → put initial state in OPEN ($f = g + h$)
2. pick state with smallest f
3. if goal → stop
4. Expand neighbours (move blank)
5. For each neighbour
   - g := parent . $g + 1$
   - h := misplaced tiles
   - $f = g + h$
6. Repeat add/update in open until goal found ~~out~~ open empty

output:

2	8	3
1	6	4
7	0	5

⇒ initial

2	8	3
1	0	4
7	6	5

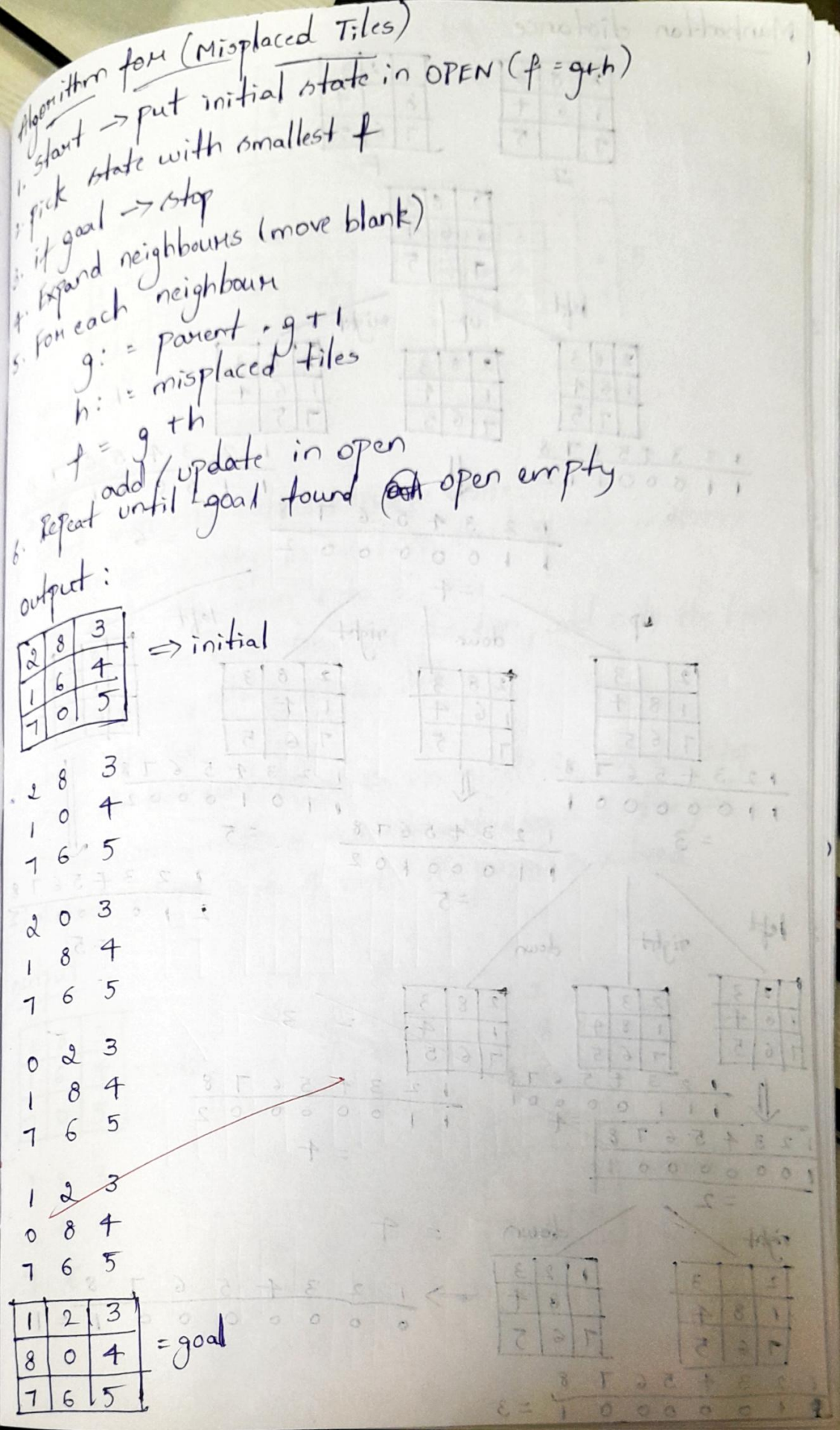
2	0	3
1	8	4
7	6	5

0	2	3
1	8	4
7	6	5

1	2	3
0	8	4
7	6	5

1	2	3
8	0	4
7	6	5

= goal



Manhattan distance

2	8	3
1	6	4
7		5

I

1	2	3
8		4
7	6	5

F

2	8	3
1	6	4
7		5

= 0

left

2	8	3
1	6	4
	7	5

1 2 3 4 5 6 7 8
1 1 0 0 0 1 1 2
= 6

up

2	8	3
1		4
7	6	5

right

2	8	3
1	6	4
7	5	

= 1

1 2 3 4 5 6 7 8
1 1 0 0 1 1 0 2
= 6

⇓

1 2 3 4 5 6 7 8
1 1 0 0 0 0 0 2
= 4

up

2		3
1	8	4
7	6	5

1 2 3 4 5 6 7 8
1 1 0 0 0 0 0 1
= 3

down

2	8	3
1	6	4
7		5

⇓

1 2 3 4 5 6 7 8
1 1 0 0 0 1 0 2
= 5

right

2	8	3
1	4	
7	6	5

1 2 3 4 5 6 7 8
1 1 0 1 0 0 0 2
= 5

left

2	8	3
	1	4
7	6	5

= 2

⇓

1 2 3 4 5 6 7 8
2 1 0 0 0 0 0 2
= 5

left

	2	3
1	8	4
7	6	5

⇓

1 2 3 4 5 6 7 8
1 0 0 0 0 0 0 1
= 2

right

2	3	
1	8	4
7	6	5

1 2 3 4 5 6 7 8
1 1 1 0 0 0 0 1
= 4

down

2	8	3
1		4
7	6	5

= 3

1 2 3 4 5 6 7 8
1 1 0 0 0 0 0 2
= 4

right

2		3
1	8	4
7	6	5

1 2 3 4 5 6 7 8
1 1 0 0 0 0 0 1
= 3

down

1	2	3
	8	4
7	6	5

= 4

⇒ 1 2 3 4 5 6 7 8
0 0 0 0 0 0 0 1
= 1