

# OUTPUT FOR 2 CASSES->

## i. MISPLACED TILES->

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832465017
14
518364720
14
725083164
16
436857012
16
351078264
12
608725341
22
745206831
18
126487053
10
034617528
10
703185246
14
-----
-
Moves Required: 20
f = 6 g = 0 h = 6
832
465
017

f = 7 g = 1 h = 6
832
065
417

f = 8 g = 2 h = 6
832
605
417

f = 9 g = 3 h = 6
832
615
407

f = 10 g = 4 h = 6
832
615
047

f = 10 g = 5 h = 5
832
015
647

f = 11 g = 6 h = 5
832
105
647

f = 12 g = 7 h = 5
802
135
647

f = 13 g = 8 h = 5
082
135

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647
f = 14 g = 9 h = 5
182
035
647

f = 14 g = 10 h = 4
182
305
647

f = 15 g = 11 h = 4
102
385
647

f = 17 g = 12 h = 5
120
385
647

f = 19 g = 13 h = 6
125
380
647

f = 20 g = 14 h = 6
125
308
647

f = 20 g = 15 h = 5
125
348
607

f = 20 g = 16 h = 4
125
348
670

f = 20 g = 17 h = 3
125
340
678

f = 20 g = 18 h = 2
120
345
678

f = 20 g = 19 h = 1
102
345
678

f = 20 g = 20 h = 0
012
345
678

Time taken to reach
Goal state: 8927
milliseconds
Nodes removed from
the frontier (): 3751
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-
Moves Required: 18
f = 6 g = 0 h = 6

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518
364
720

f = 7 g = 1 h = 6
518
360
724

f = 8 g = 2 h = 6
510
368
724

f = 10 g = 3 h = 7
501
368
724

f = 11 g = 4 h = 7
051
368
724

f = 13 g = 5 h = 8
351
068
724

f = 14 g = 6 h = 8
351
608
724

f = 15 g = 7 h = 8
351
628
704

f = 16 g = 8 h = 8
351
628
740

f = 16 g = 9 h = 7
351
620
748

f = 17 g = 10 h = 7
351
602
748

f = 18 g = 11 h = 7
301
652
748

f = 18 g = 12 h = 6
310
652
748

f = 18 g = 13 h = 5
312
650
748

f = 18 g = 14 h = 4
312

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|                     |   |  |  |
|---------------------|---|--|--|
| ii.                 | 6 0 5<br>7 4 8  | f = 14 g = 5 h = 9<br>8 3 2<br>0 1 5<br>6 4 7  | f = 20 g = 19 h = 1<br>1 0 2<br>3 4 5<br>6 7 8   |
|                     | f = 18 g = 15 h = 3<br>3 1 2<br>6 4 5<br>7 0 8  | f = 14 g = 6 h = 8<br>0 3 2<br>8 1 5<br>6 4 7  | f = 20 g = 20 h = 0<br>0 1 2<br>3 4 5<br>6 7 8   |
|                     | f = 18 g = 16 h = 2<br>3 1 2<br>6 4 5<br>0 7 8  | f = 14 g = 7 h = 7<br>3 0 2<br>8 1 5<br>6 4 7  | Time taken to reach<br>Goal state: 290<br>milliseconds<br>Nodes removed from<br>the frontier (): 517<br>-----  |
|                     | f = 18 g = 17 h = 1<br>3 1 2<br>0 4 5<br>6 7 8  | f = 14 g = 8 h = 6<br>3 1 2<br>8 0 5<br>6 4 7  | -<br>Moves Required: 18<br>f = 12 g = 0 h = 12<br>5 1 8<br>3 6 4<br>7 2 0  |
|                     | f = 18 g = 18 h = 0<br>0 1 2<br>3 4 5<br>6 7 8  | f = 14 g = 9 h = 5<br>3 1 2<br>0 8 5<br>6 4 7  | f = 14 g = 1 h = 13<br>5 1 8<br>3 6 0<br>7 2 4   |
| MANHATTAN           | 8 3 2 4 6 5 0 1 7<br>14<br>5 1 8 3 6 4 7 2 0<br>14<br>7 2 5 0 8 3 1 6 4<br>16<br>4 3 6 8 5 7 0 1 2<br>16<br>3 5 1 0 7 8 2 6 4<br>12<br>6 0 8 7 2 5 3 4 1<br>22<br>7 4 5 2 0 6 8 3 1<br>18<br>1 2 6 4 8 7 0 5 3<br>10<br>0 3 4 6 1 7 5 2 8<br>10<br>7 0 3 1 8 5 2 4 6<br>14<br>----- | f = 14 g = 10 h = 4<br>0 1 2<br>3 8 5<br>6 4 7<br><br>f = 16 g = 11 h = 5<br>1 0 2<br>3 8 5<br>6 4 7<br><br>f = 18 g = 12 h = 6<br>1 2 0<br>3 8 5<br>6 4 7<br><br>f = 20 g = 13 h = 7<br>1 2 5<br>3 8 0<br>6 4 7   | f = 14 g = 2 h = 12<br>5 1 0<br>3 6 8<br>7 2 4<br><br>f = 16 g = 3 h = 13<br>5 0 1<br>3 6 8<br>7 2 4<br><br>f = 16 g = 4 h = 12<br>0 5 1<br>3 6 8<br>7 2 4<br><br>f = 18 g = 5 h = 13<br>3 5 1<br>0 6 8<br>7 2 4   |
| DISTANCE HEURISTIC- | -<br>Moves Required: 20<br>f = 12 g = 0 h = 12<br>8 3 2<br>4 6 5<br>0 1 7   | f = 20 g = 14 h = 6<br>1 2 5<br>3 0 8<br>6 4 7<br><br>f = 20 g = 15 h = 5<br>1 2 5<br>3 4 8<br>6 0 7<br><br>f = 20 g = 16 h = 4<br>1 2 5<br>3 4 8<br>6 7 0<br><br>f = 20 g = 17 h = 3<br>1 2 5<br>3 4 0<br>6 7 8<br><br>f = 20 g = 18 h = 2<br>1 2 0<br>3 4 5<br>6 7 8 | f = 18 g = 6 h = 12<br>3 5 1<br>6 0 8<br>7 2 4<br><br>f = 18 g = 7 h = 11<br>3 5 1<br>6 2 8<br>7 0 4<br><br>f = 18 g = 8 h = 10<br>3 5 1<br>6 2 8<br>7 4 0<br><br>f = 18 g = 9 h = 9<br>3 5 1<br>6 2 0<br>7 4 8<br><br>f = 18 g = 10 h = 8<br>3 5 1<br>6 0 2 |

|      |                     |                     |                       |
|------|---------------------|---------------------|-----------------------|
|      | 7 4 8               | Moves Required: 20  | f = 20 g = 14 h = 6   |
|      | f = 18 g = 11 h = 7 | f = 9 g = 0 h = 9   | 1 2 5                 |
|      | 3 0 1               | 8 3 2               | 3 0 8                 |
|      | 6 5 2               | 4 6 5               | 6 4 7                 |
|      | 7 4 8               | 0 1 7               |                       |
|      | f = 18 g = 12 h = 6 | f = 11 g = 1 h = 10 | f = 20 g = 15 h = 5   |
|      | 3 1 0               | 8 3 2               | 1 2 5                 |
|      | 6 5 2               | 4 6 5               | 3 4 8                 |
|      | 7 4 8               | 1 0 7               | 6 0 7                 |
|      | f = 18 g = 13 h = 5 | f = 11 g = 2 h = 9  | f = 20 g = 16 h = 4   |
|      | 3 1 2               | 8 3 2               | 1 2 5                 |
|      | 6 5 0               | 4 0 5               | 3 4 8                 |
|      | 7 4 8               | 1 6 7               | 6 7 0                 |
|      | f = 18 g = 14 h = 4 | f = 11 g = 3 h = 8  | f = 20 g = 17 h = 3   |
|      | 3 1 2               | 8 3 2               | 1 2 5                 |
|      | 6 0 5               | 0 4 5               | 3 4 0                 |
|      | 7 4 8               | 1 6 7               | 6 7 8                 |
|      | f = 18 g = 15 h = 3 | f = 12 g = 4 h = 8  | f = 20 g = 18 h = 2   |
|      | 3 1 2               | 8 3 2               | 1 2 0                 |
|      | 6 4 5               | 1 4 5               | 3 4 5                 |
|      | 7 0 8               | 0 6 7               | 6 7 8                 |
|      | f = 18 g = 16 h = 2 | f = 12 g = 5 h = 7  | f = 20 g = 19 h = 1   |
|      | 3 1 2               | 8 3 2               | 1 0 2                 |
|      | 6 4 5               | 1 4 5               | 3 4 5                 |
|      | 0 7 8               | 6 0 7               | 6 7 8                 |
|      | f = 18 g = 17 h = 1 | f = 14 g = 6 h = 8  | f = 20 g = 20 h = 0   |
|      | 3 1 2               | 8 3 2               | 0 1 2                 |
|      | 0 4 5               | 1 0 5               | 3 4 5                 |
|      | 6 7 8               | 6 4 7               | 6 7 8                 |
|      | f = 18 g = 18 h = 0 | f = 14 g = 7 h = 7  | Time taken to reach   |
|      | 0 1 2               | 8 0 2               | Goal state: 816       |
|      | 3 4 5               | 1 3 5               | milliseconds          |
|      | 6 7 8               | 6 4 7               | Nodes removed from    |
|      |                     |                     | the frontier (): 1014 |
|      |                     |                     | -----                 |
|      |                     | f = 15 g = 8 h = 7  | -                     |
|      |                     | 0 8 2               | Moves Required: 18    |
|      |                     | 1 3 5               | f = 9 g = 0 h = 9     |
|      |                     | 6 4 7               | 5 1 8                 |
|      |                     |                     | 3 6 4                 |
|      |                     | f = 15 g = 9 h = 6  | 7 2 0                 |
|      |                     | 1 8 2               |                       |
| iii. | Novel_heuristic-    | 0 3 5               | f = 11 g = 1 h = 10   |
|      | 8 3 2 4 6 5 0 1 7   | 6 4 7               | 5 1 8                 |
|      | 14                  |                     | 3 6 0                 |
|      | 5 1 8 3 6 4 7 2 0   | f = 15 g = 10 h = 5 | 7 2 4                 |
|      | 14                  | 1 8 2               |                       |
|      | 7 2 5 0 8 3 1 6 4   | 3 0 5               | f = 12 g = 2 h = 10   |
|      | 16                  | 6 4 7               | 5 1 0                 |
|      | 4 3 6 8 5 7 0 1 2   |                     | 3 6 8                 |
|      | 16                  | f = 16 g = 11 h = 5 | 7 2 4                 |
|      | 3 5 1 0 7 8 2 6 4   | 1 0 2               |                       |
|      | 12                  | 3 8 5               | f = 14 g = 3 h = 11   |
|      | 6 0 8 7 2 5 3 4 1   | 6 4 7               | 5 0 1                 |
|      | 22                  |                     | 3 6 8                 |
|      | 7 4 5 2 0 6 8 3 1   | f = 18 g = 12 h = 6 | 7 2 4                 |
|      | 18                  | 1 2 0               |                       |
|      | 1 2 6 4 8 7 0 5 3   | 3 8 5               | f = 15 g = 4 h = 11   |
|      | 10                  | 6 4 7               | 0 5 1                 |
|      | 0 3 4 6 1 7 5 2 8   |                     | 3 6 8                 |
|      | 10                  | f = 20 g = 13 h = 7 | 7 2 4                 |
|      | 7 0 3 1 8 5 2 4 6   | 1 2 5               |                       |
|      | 14                  | 3 8 0               | f = 17 g = 5 h = 12   |
|      | -----               | 6 4 7               | 3 5 1                 |
|      | -                   |                     | 0 6 8                 |

7 2 4

Nodes removed from  
the frontier (): 377

f = 17 g = 6 h = 11

3 5 1

6 0 8

7 2 4

f = 18 g = 7 h = 11

3 5 1

6 2 8

7 0 4

f = 18 g = 8 h = 10

3 5 1

6 2 8

7 4 0

f = 18 g = 9 h = 9

3 5 1

6 2 0

7 4 8

f = 18 g = 10 h = 8

3 5 1

6 0 2

7 4 8

f = 18 g = 11 h = 7

3 0 1

6 5 2

7 4 8

f = 18 g = 12 h = 6

3 1 0

6 5 2

7 4 8

f = 18 g = 13 h = 5

3 1 2

6 5 0

7 4 8

f = 18 g = 14 h = 4

3 1 2

6 0 5

7 4 8

f = 18 g = 15 h = 3

3 1 2

6 4 5

7 0 8

f = 18 g = 16 h = 2

3 1 2

6 4 5

0 7 8

f = 18 g = 17 h = 1

3 1 2

0 4 5

6 7 8

f = 18 g = 18 h = 0

0 1 2

3 4 5

6 7 8

Time taken to reach  
Goal state: 238  
milliseconds