



A* TO SOLVE THE MODIFIED N-PUZZLE PROBLEM

Kabilan Mahathevan (190283C)

University of Moratuwa | Department of Computer Science and Engineering




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Test on the different heuristic function for A* algorithm

Result of using Number of Misplaced Tiles and Total Manhattan Distance as heuristic function in A* algorithm for modified n-puzzle problem is provided below.

Table below gives the number of nodes expanded before finding the solution by each heuristic function.

Test is done for 100 randomly generated n-puzzle problem.

Misplaced Tiles	Total Manhattan Distance
76	76
62	62
20	20
219	54
218	38
93	74
76	76
39	39
4871	502
227	71
453	143
1384	600
212	62
164	164
68	53
48	48
55	55
47	47
54	34
54	54
34	34
170	111
99	99

565	98
98	98
6650	572
48	48
119	119
980	125
654	155
7169	389
116	116
594	384
468	107
47	47
45	38
18202	356
437	127
437	127
1344	280
31	24
34	34
172	118
44	44
338	219
77	62
284	79
142	43
153	97
42	23
2488	255
80	80
2	2
8	8
1621	283
69	47
17878	1109
130	78
44	44
35	35
378	47
2390	341
47	47
31	31
2922	458
62	62

184	164
34	34
206	80
59	59
93	43
143	98
109	47
125	118
526	181
333	87
34	34
20	20
1322	406
512	87
111	104
80	80
11	11
34	34
47	41
167	167
98	98
233	30
791	175
217	83
1671	199
332	161
355	223
129	47
11	11
55	36
226	41
527	188
3449	373
1346	199

Analysis on the test results

An analysis on the above result was done using paired t-test to assess the statistical significance of the difference in nodes expanded before finding a solution for each heuristic function.

Test Result of paired t-test:

Total test samples: 100

P value and statistical significance.

The two-tailed P value = 0.0042

By conventional criteria, this difference is considered to be very statistically significant.

Confidence interval:

The mean of Misplaced Tiles – Total Manhattan Distance = 766.77

95% confidence interval of this difference: From 247.34 to 1286.20

	Misplaced Tiles	Total Manhattan Distance
Mean	898.08	131.31
Standard Deviation	2734.91	158.98
Standard Error of the Mean	273.49	15.90

Result is tested in: <https://www.graphpad.com/quickcalcs/ttest1/?format=C>

Implementation

Zip file of the implementation is submitted along with this test result.

Remote repository of the implementation: https://github.com/KabilanMA/modified_n_puzzle.git

Run on Google Colab: <https://colab.research.google.com/drive/1Oc2a8jLSM-eu2RLFhM5L6X-vKaQ63alb?usp=sharing>