LAB ASSIGNMENT 1

INTRODUCTION TO AI

7	2	4		0	1	2
5	0	6		3	4	5
8	3	1		6	7	8
INITIAL STATE				MISPLACED TILES		

Misplaced Tiles Heuristic = Number of misplaced tiles (h1 = 8)

Manhattan Distance Heuristic = Sum of Manhattan distances of the tiles from their goal positions. (h2 = 3 + 1 + 2 + 2 + 2 + 3 + 3 + 2 = 18)

Novel Heuristic used = Number of tiles out of row + Number of tiles out of column (h3 = 5 (out of row) + 8 (out of column) = 13)

	Misplaced Tiles	Manhattan Distance	Novel Heuristic
Time taken per solvable initial state(10 states)	State 1 : 6990 ms State 2 : 768 ms State 3 : 3443 ms State 4 : 1272082 ms State 5 : 635 ms State 6 : 1145399ms State 7 : 582738 ms State 8 : 351525 ms State 9 : 9867 ms State 10 : 156687 ms	State 1 : 256 ms State 2 : 144 ms State 3 : 159 ms State 4 : 4414 ms State 5 : 128 ms State 6 : 8477 ms State 7 : 2173 ms State 8 : 2039 ms State 9 : 159 ms State 10 : 544 ms	State 1 : 541 ms State 2 : 165 ms State 3 : 275 ms State 4 : 57122 ms State 5 : 93 ms State 6 : 55622 ms State 7 : 17186 ms State 8 : 14964 ms State 9 : 467 ms State 10 : 4800 ms
Length of each solution (10 states)	State 1 : 20 moves State 2 : 18 moves State 3 : 19 moves State 4 : 26 moves State 5 : 17 moves State 6 : 25 moves State 7 : 24 moves State 8 : 24 moves State 9 : 20 moves State 10 : 23 moves	State 1 : 20 moves State 2 : 18 moves State 3 : 19 moves State 4 : 26 moves State 5 : 17 moves State 6 : 25 moves State 7 : 24 moves State 8 : 24 moves State 9 : 20 moves State 10 : 23 moves	State 1 : 20 moves State 2 : 18 moves State 3 : 19 moves State 4 : 26 moves State 5 : 17 moves State 6 : 25 moves State 7 : 24 moves State 8 : 24 moves State 9 : 20 moves State 10 : 23 moves
Nodes removed from the frontier (10 states)	State 1 : 3751 nodes State 2 : 1237 nodes State 3 : 2461 nodes State 4 : 46223 nodes State 5 : 1042 nodes State 6 : 44590 nodes State 7 : 25789 nodes State 8 : 21164 nodes State 9 : 3626 nodes State 10 : 13963 nodes	State 1 : 517 nodes State 2 : 161 nodes State 3 : 244 nodes State 4 : 2571 nodes State 5 : 129 nodes State 6 : 3479 nodes State 7 : 1556 nodes State 8 : 1786 nodes State 9 : 402 nodes State 10 : 742 nodes	State 1 : 1014 nodes State 2 : 377 nodes State 3 : 607 nodes State 4 : 10579 nodes State 5 : 282 nodes State 6 : 10021 nodes State 7 : 5681 nodes State 8 : 5190 nodes State 9 : 951 nodes State 10 : 2893 nodes

Average Time taken by A* algorithm using misplaced tiles heuristic- 353.003 second

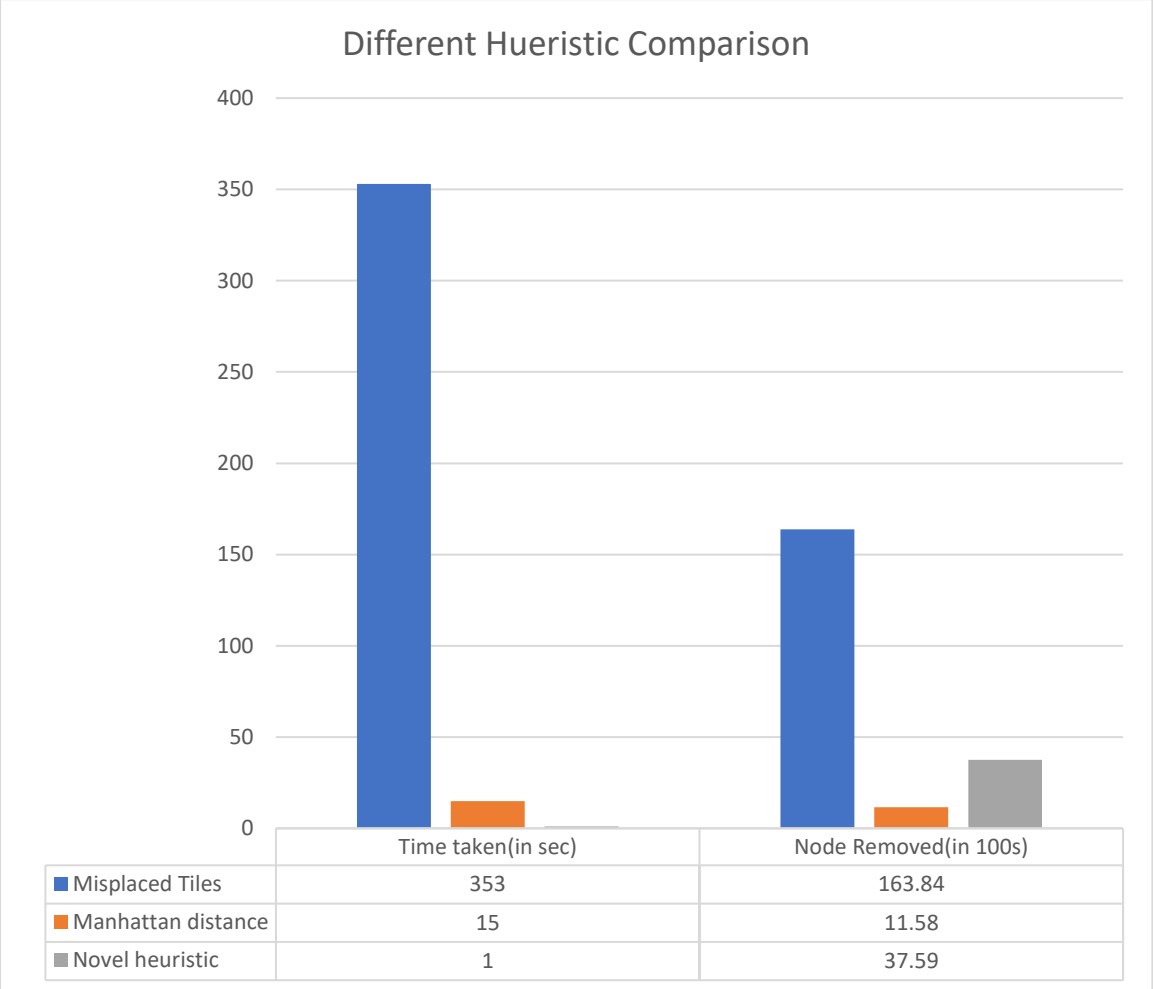
Average Time taken by A* algorithm using Manhattan distance heuristic- 1.849 second

Average Time taken by A* algorithm using Novel heuristic- 15.123 second

Average node removed from the frontier by A* algorithm using misplaced tiles heuristic- 16384 nodes

Average node removed from the frontier by A* algorithm using Manhattan distance heuristic- 1158 nodes

Average node removed from the frontier by A* algorithm using Novel heuristic- 3759 nodes



Conclusion/Justification – From the graph it is clear that Manhattan Distance heuristic is best performer followed by the novel heuristic and then at last Misplaced tiles heuristic. Time taken by Manhattan distance heuristic is far bettern than other two and also it removes less number of nodes from the frontier. The length of the each initial state in all the three case is same which proves the correctness of the program.