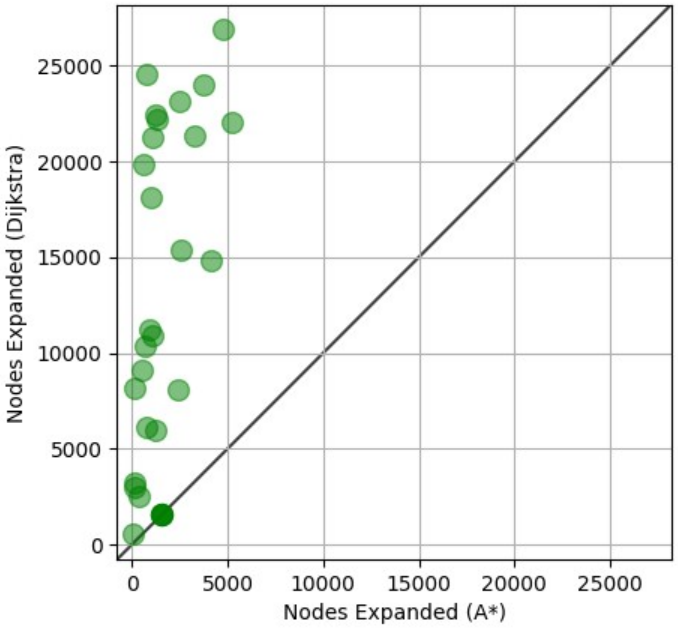
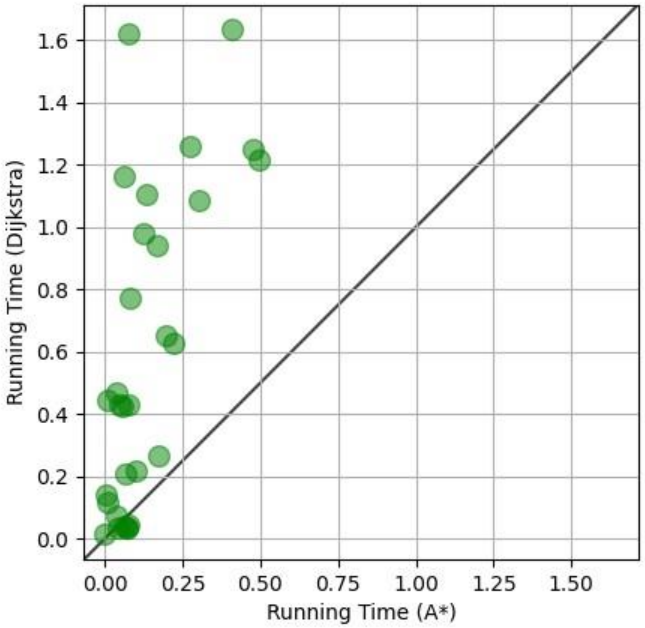
Answers


Nodes Expanded (Dijkstra)
Nodes Expanded (A*)
0
5000
10000
15000
20000
25000


Running Time (Dijkstra)
Running Time (A*)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0.00
0.25
0.50
0.75
1.00
1.25
1.50

1) a) Dijkstra's algorithm expands the cheapest node in all directions before it moves to the next cheapest node. It expands nodes that may not necessarily be in the right direction to reach the goal state. A* algorithm on the other hand, expands nodes that are mostly in the right direction towards the goal state. As a result, it expands less nodes compared to Dijkstra's algorithm which in turn leads to finding the optimal solution path in less time. This is also seen in plots as most points are above the diagonal which means that A* expanded less nodes and took less time to find the optimal solution path as compared to Dijkstra.

   b) The runtime plot is shifted slightly to the right. This is because A* must dedicate some time to evaluating the heuristic, among other things.

2) The code for WA* is not working as expected because the solution cost for WA* is higher than that for Dijkstra's algorithm. A correct implementation of WA* with W = 2 can produce solutions with cost *at most* twice the solution cost of Djikstra.