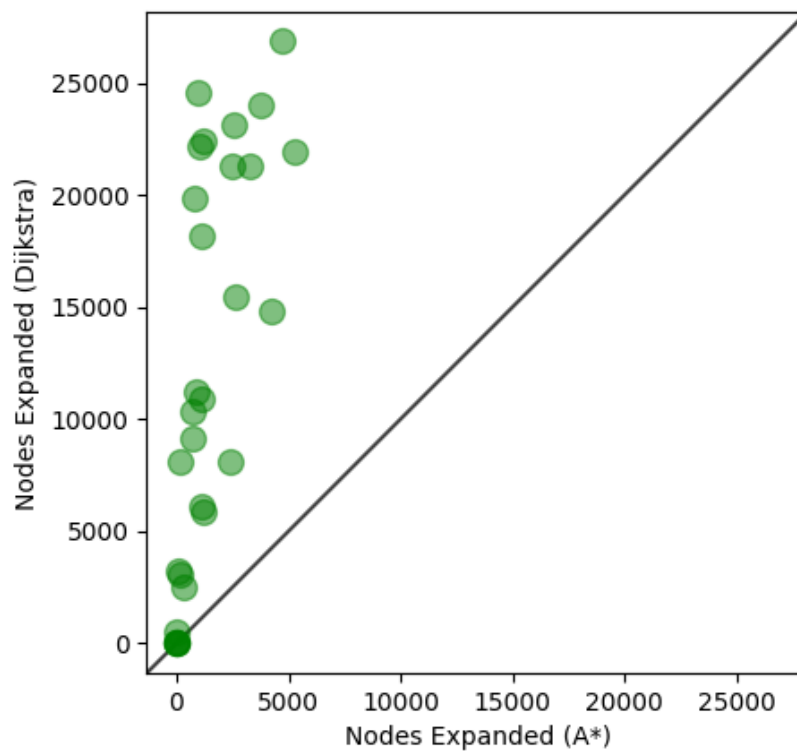
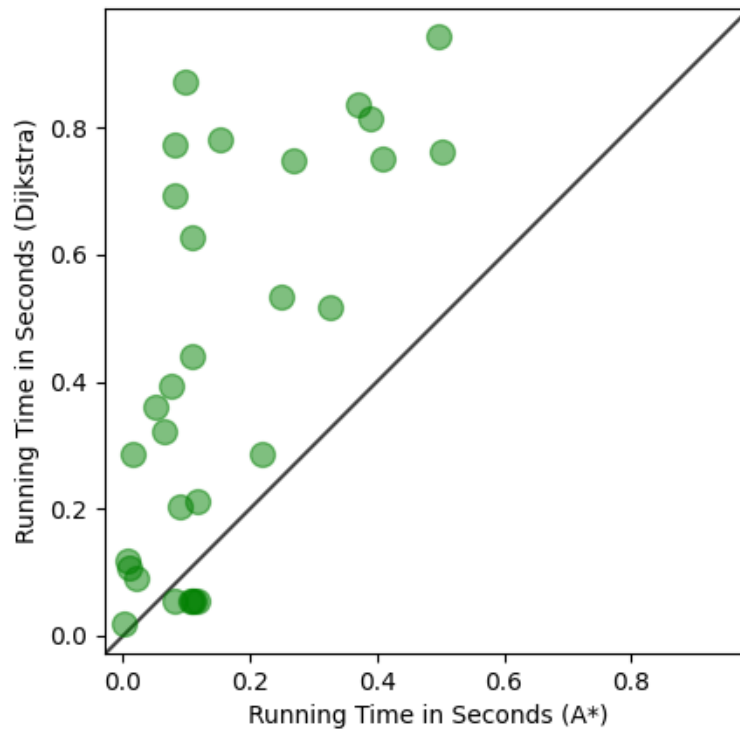
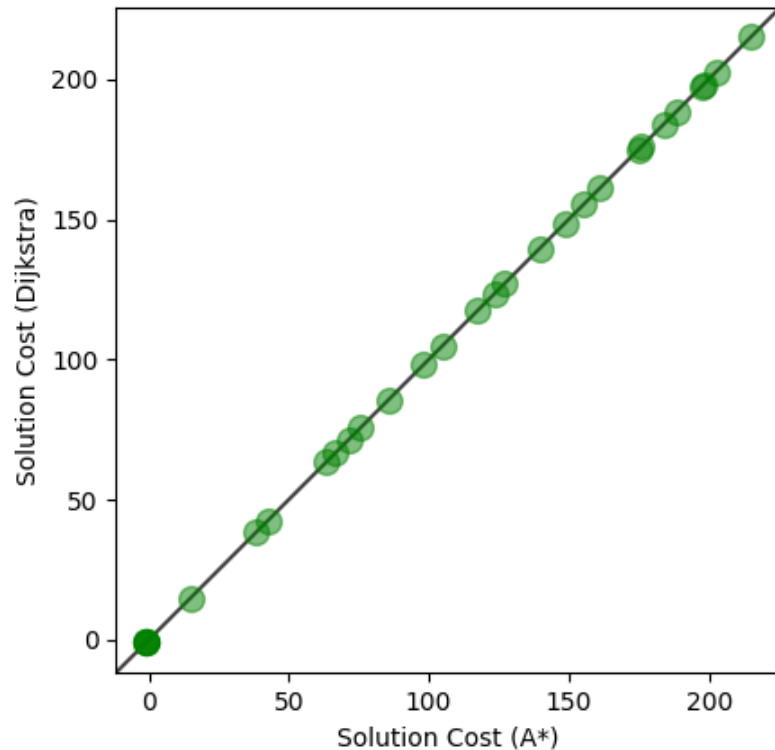


CMPUT366 Assignment Analysis

- Original Heuristic Function: $h(s) = \max(\Delta x, \Delta y) + 0.5 \times \min(\Delta x, \Delta y)$:



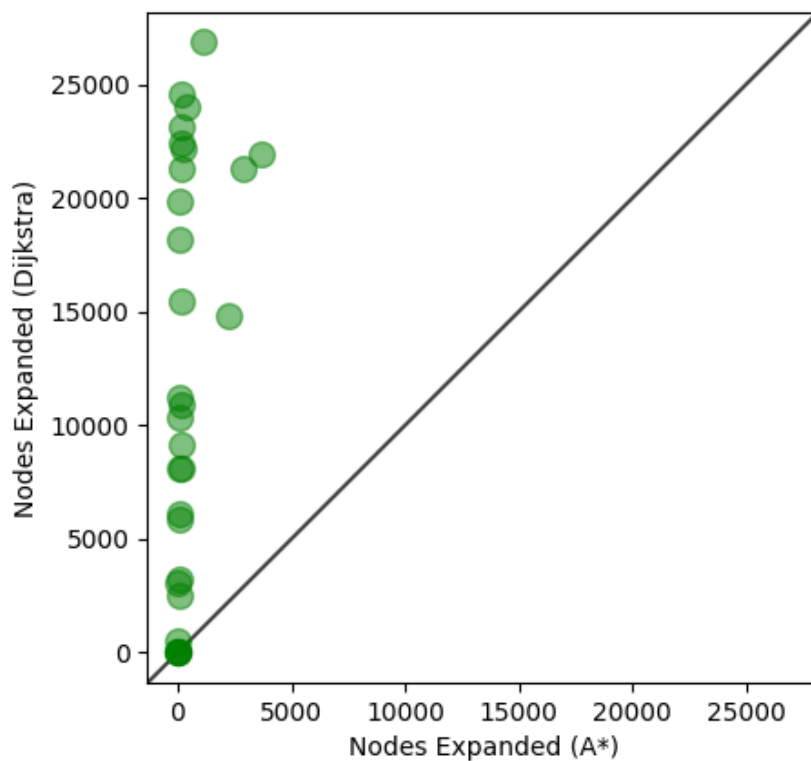
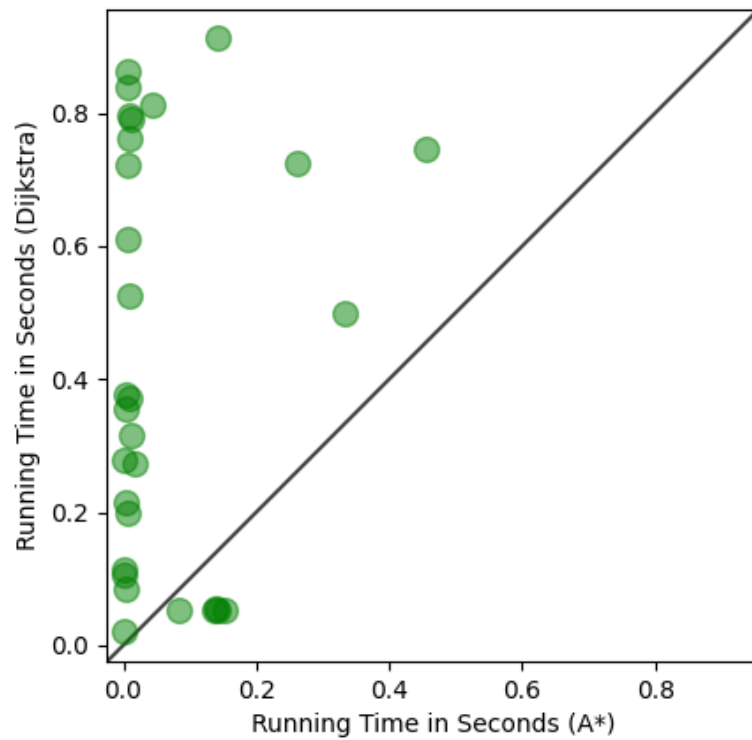


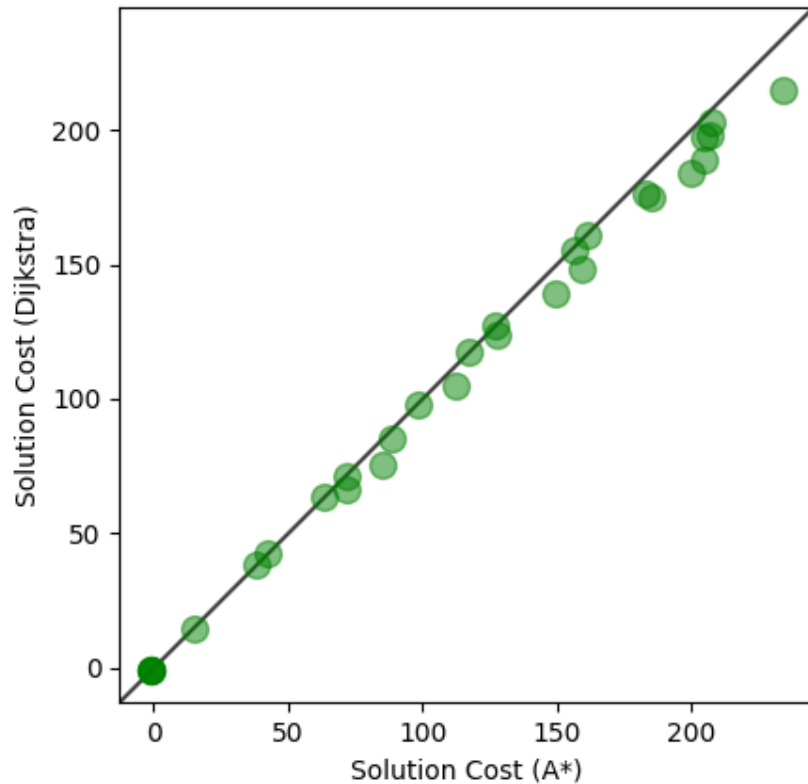
The scatter plot of solution costs indicates the solution costs are approximately the same for the two algorithms since nearly all the points are on the diagonal. While the other two scatter plots show the number of nodes expanded and running time are not identical for the two algorithms.

It is obvious that the number of expanded nodes of A* algorithm is much less than that of Dijkstra algorithm (approximately 5000 vs 26500). Thus, the running time of A* is also less than Dijkstra, with approximately 0.5 vs 0.9. This result is reasonable since there is a positive proportional relationship between number of expanded nodes and running time, that is, expanding more nodes will result in an increase of running time. This is also the reason why the scatter plots of nodes expanded and running time are all different for the two algorithms.

Overall, the two algorithms both give us correct solution. Their costs are nearly the same, however, it might be a good idea to choose A* algorithm if you really time complexity.

- Multiplicative Factor of Heuristic Function: $h(s) = 2 \times (\max(\Delta x, \Delta y) + 0.5 \times \min(\Delta x, \Delta y))$:





The scatter plot of solution cost is almost the same as previous question, which represents that the inflating heuristic function will not impact the solution cost of the A* algorithm.

On the other hand, we can witness a decrease of the the number of nodes expanded for A* algorithm from the scatter plot of number of nodes expanded, and it results in a decrease of the running time of A* algorithm also. That could be the inflated heuristic function being not accurate enough, and we miss a number of nodes we should expand like in the previous scenario. This assumption comes from the result of A* algorithm, it does not always find the optimal solution like the original one, which means the nodes expanding procedure must be incorrect.

This experiment really represent the importance of heuristic function, we must ensure our heuristic function is correct and accurate to find the optimal solution.