

COMP472

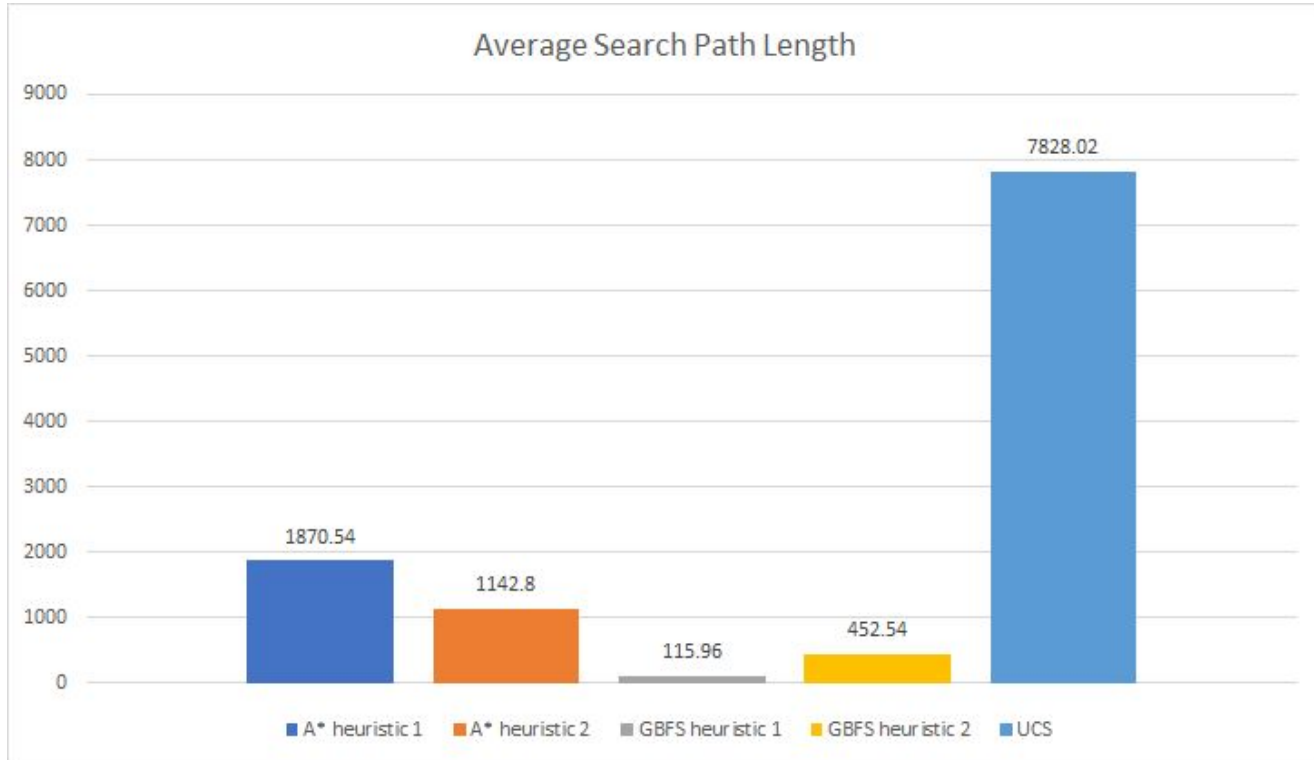
Assignment 2

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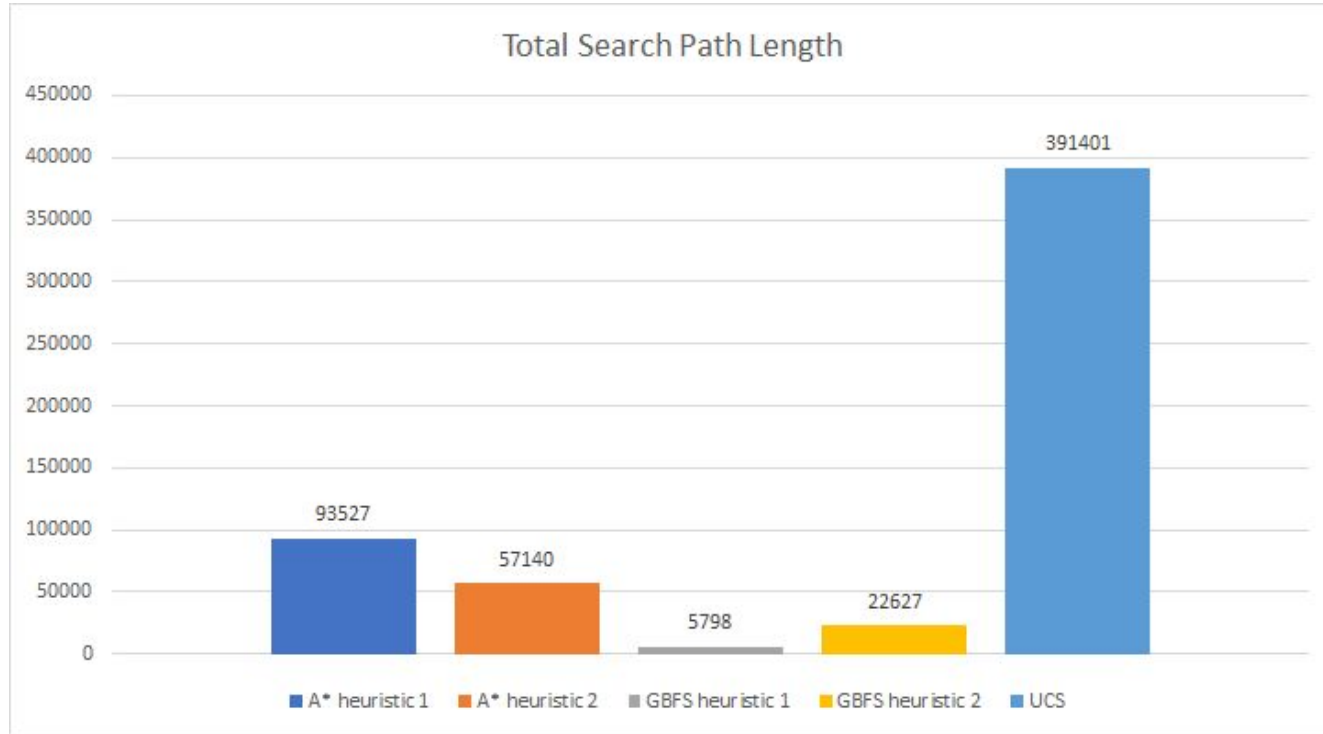
Heuristics

- Order Check
 - For each row, check if each value is smaller than the next one. For each set that isn't, the heuristic value increments by 1.
 - The last index is excluded (Position of 0).
- RowCol check
 - Checks if the values in the row of puzzle is in the goal state. If the number is not there the number of incorrect positions will increment by 1.
 - Checks if the values in the column of the puzzle is in the goal state. If the number is not there, the number of incorrect positions will increment by 1.
 - Finally, the total number of incorrect positions will be added together forming the heuristic value.

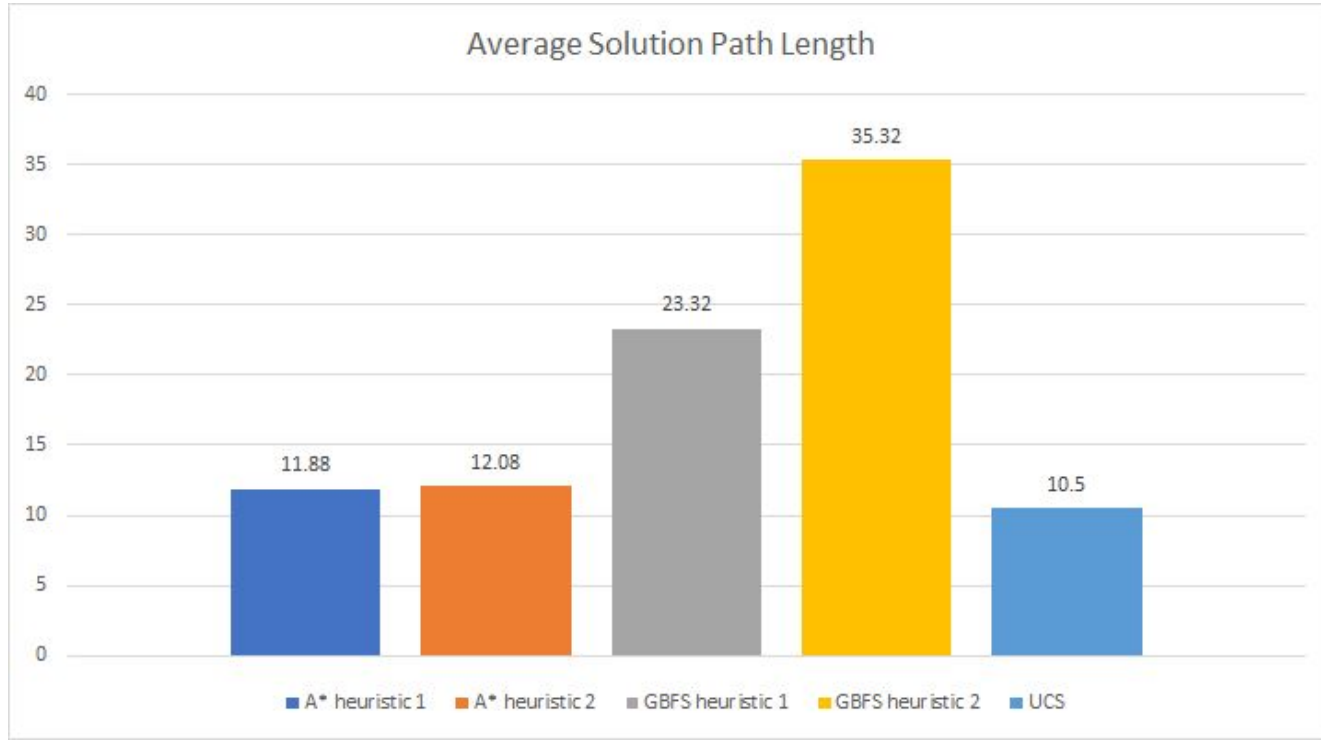
Analysis - Search Path Length



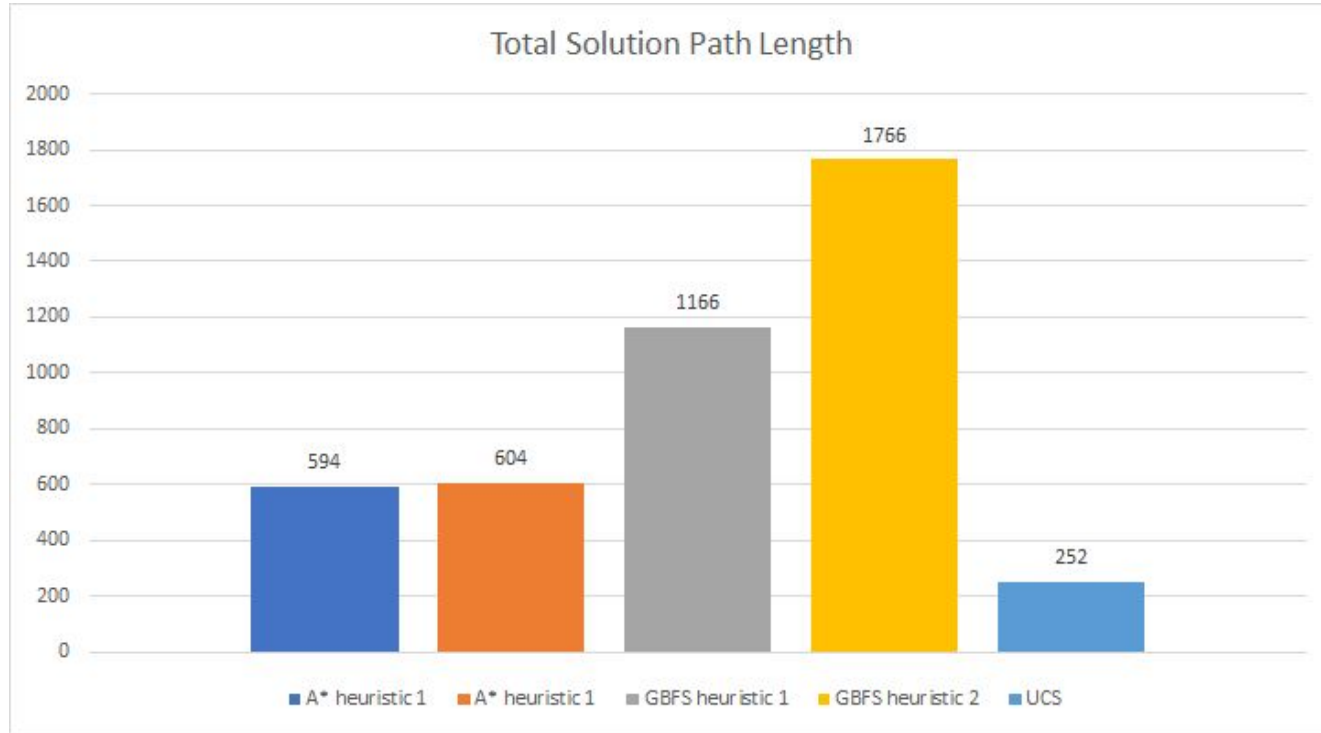
Analysis - Search Path Length



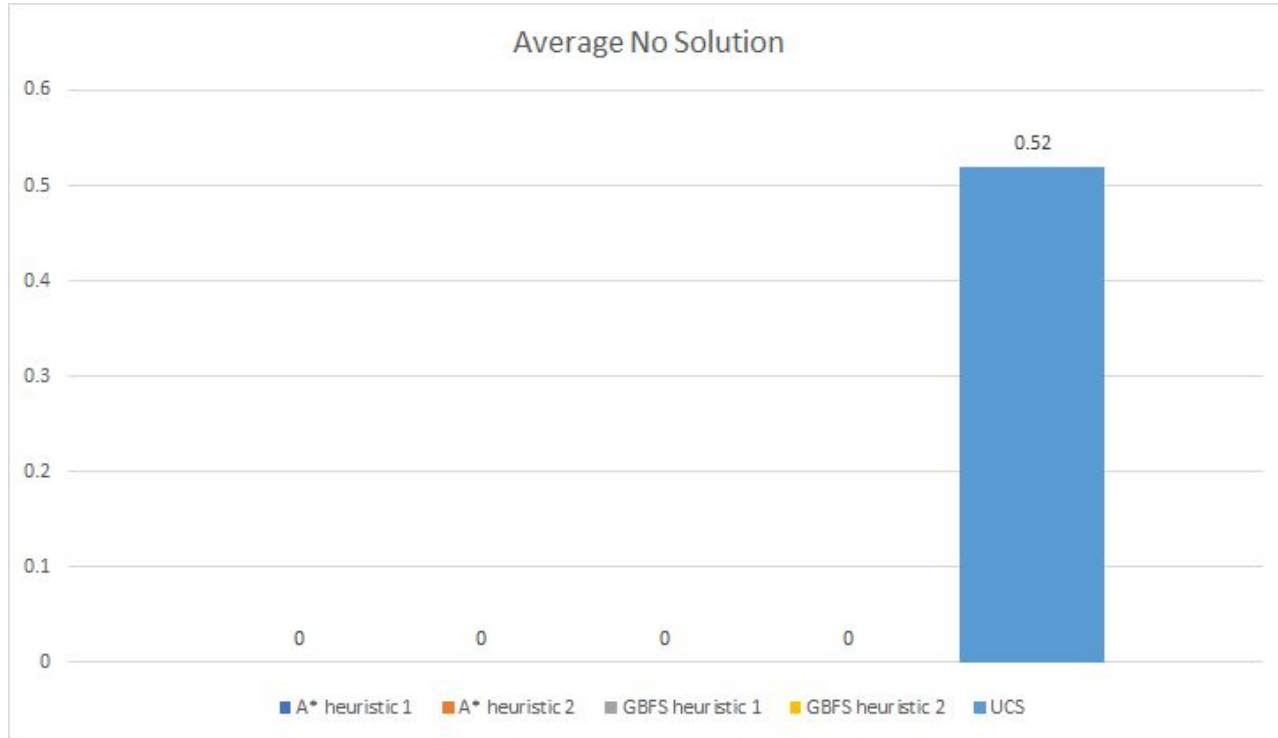
Analysis - Solution Path Length



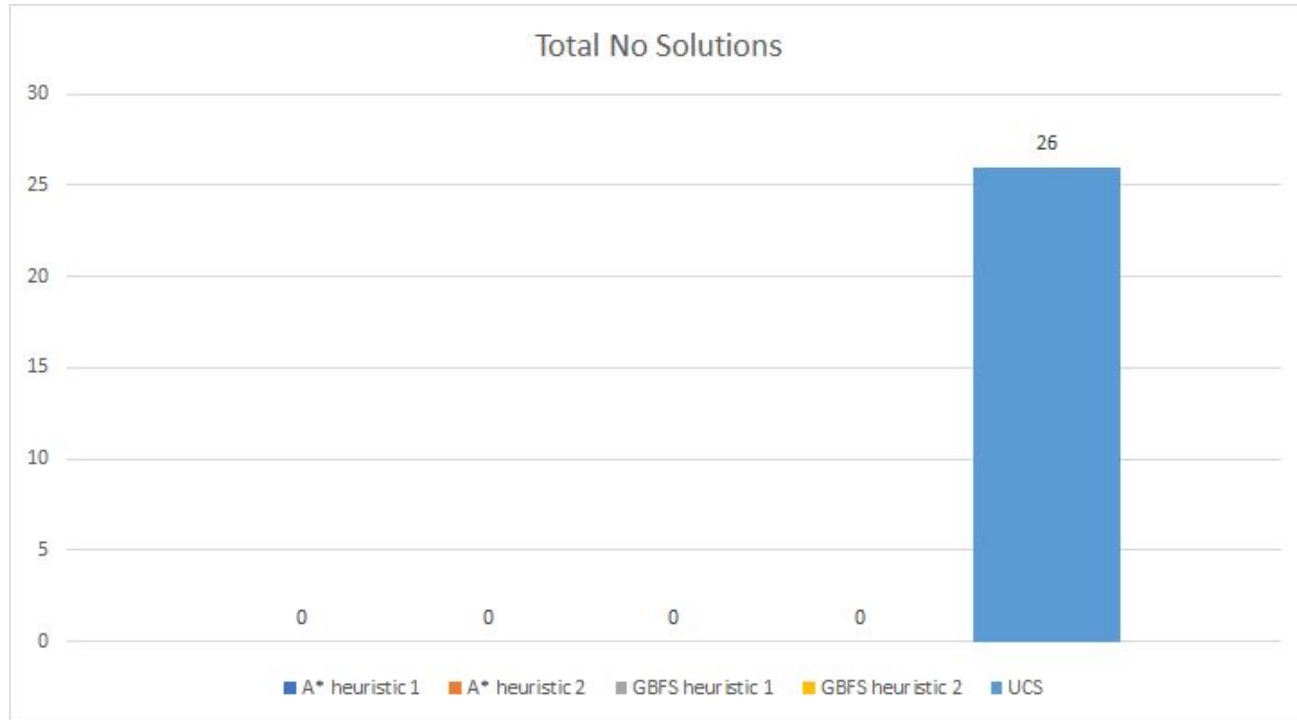
Analysis - Solution Path Length



Analysis - No Solution



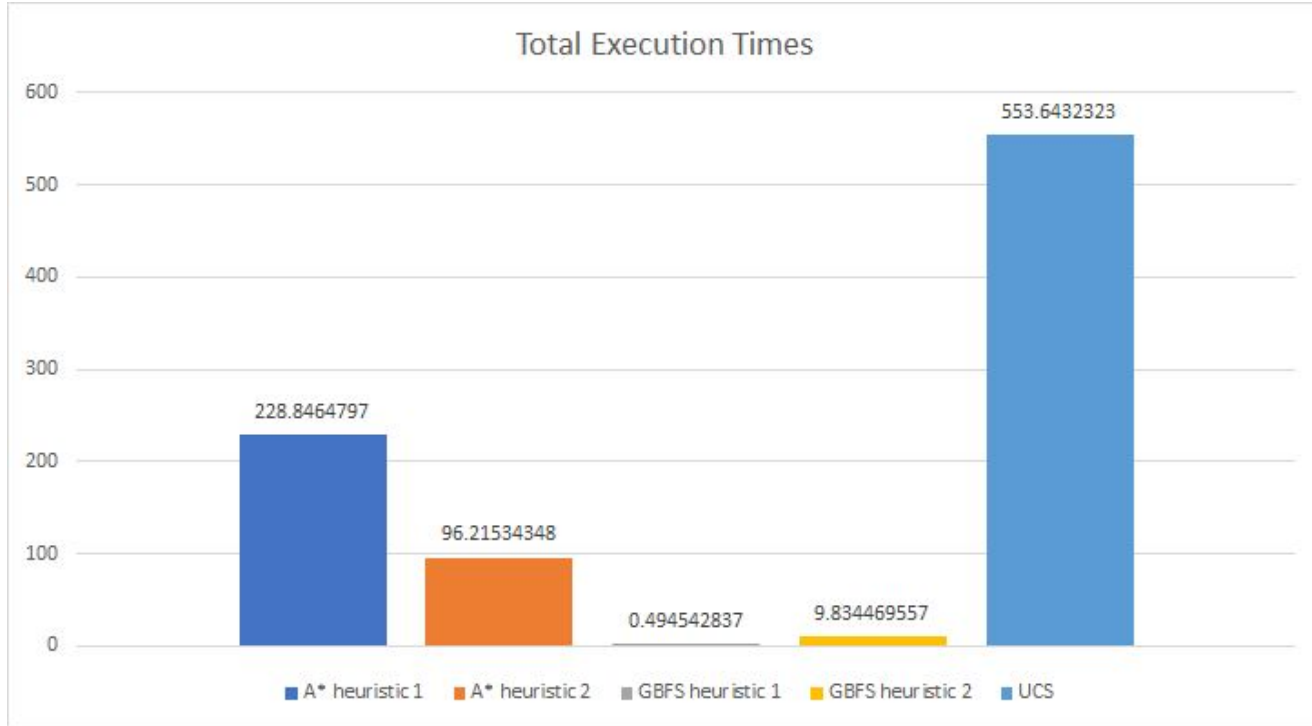
Analysis - No Solution



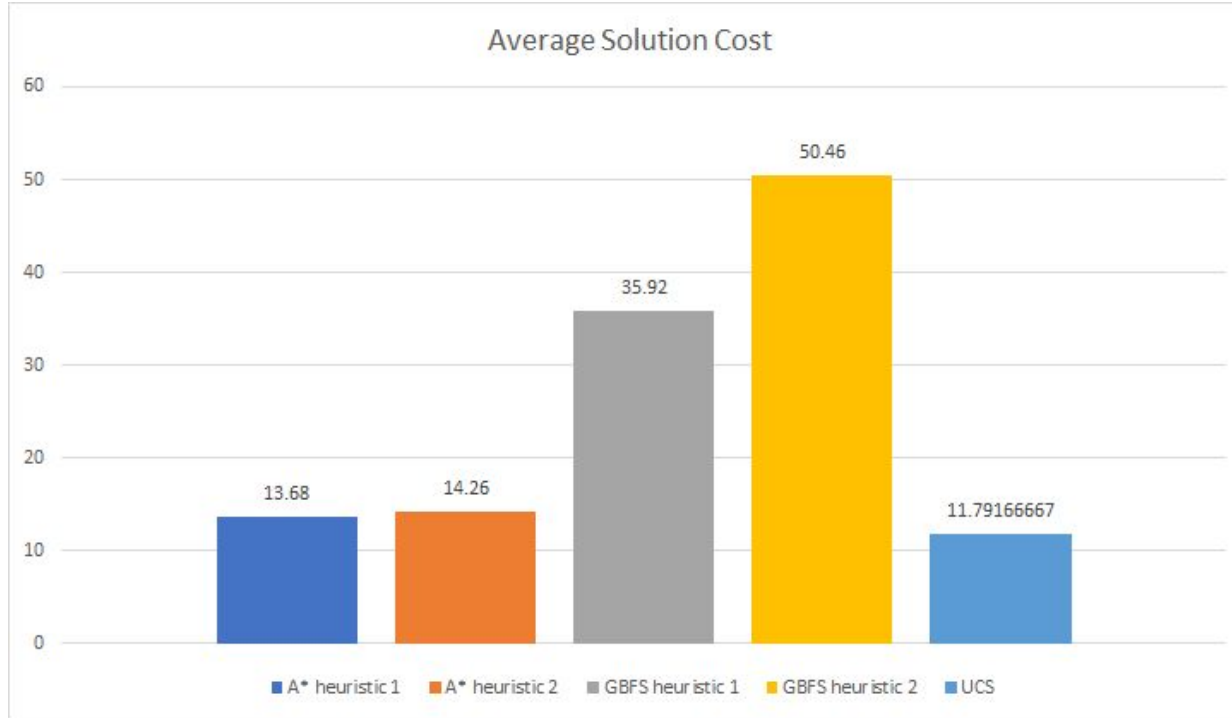
Analysis - Execution Time



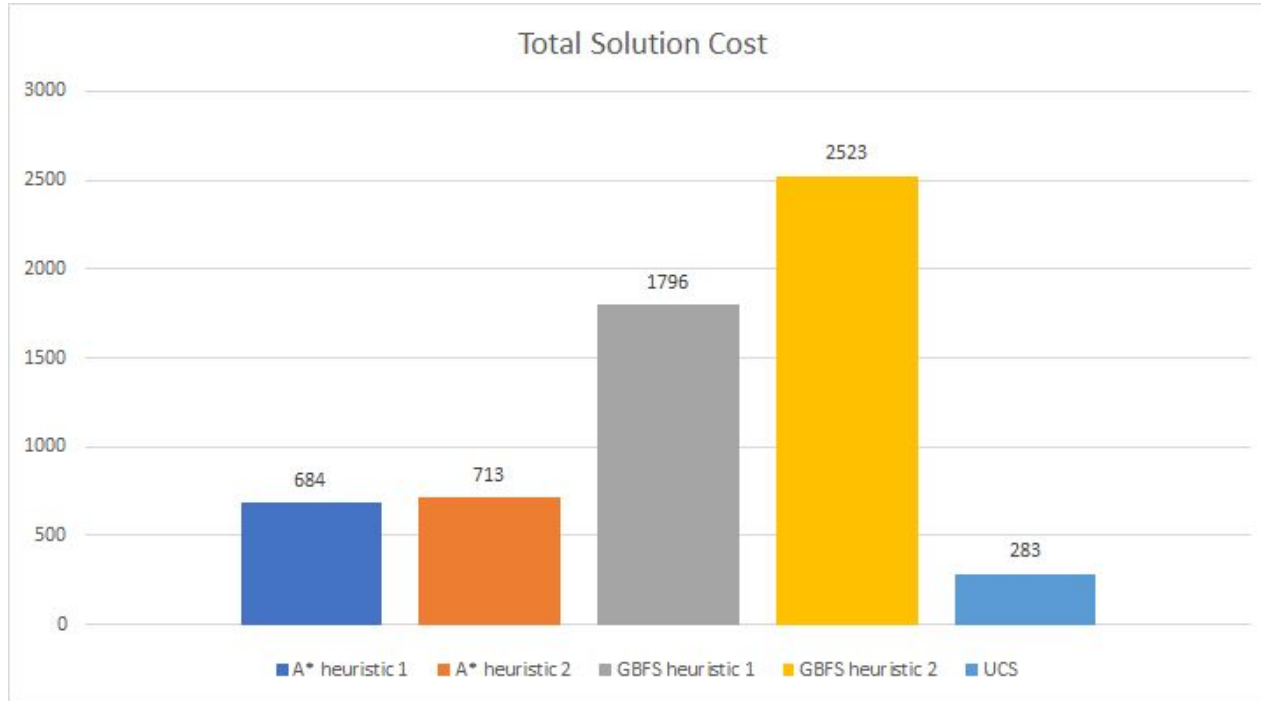
Analysis - Execution Time



Analysis - Solution Cost



Analysis - Solution Cost



Optimality of Solution

- UCS returns the least cost solution
 - However, it often times out and has an immense search path (As expected)
- A* returns fairly optimal solutions
 - Heuristic 1: Returns the least cost solutions (Same as UCS) which means the heuristic is admissible
 - The search path is much shorter than UCS
 - The execution time is shorter than UCS
 - Heuristic 2: Does not return the least cost solution, but returns a solution with a fairly low cost (The heuristic is not admissible)
- GBFS returns solutions **very** fast
 - Does **not** return the least cost solution (As expected)
 - Search path length is very short, but solution path and cost can become large

Scaling Up

- Horizontal Scaling (2x4, 2x5, 2x10, etc.)
- A* and UCS... Take a very long time, as expected
 - The number of children grows absurdly fast
 - Even with heuristics, A* still has to go through a very large amount of children
- GBFS fairs better
 - Results still came in fairly quickly (< 5s) for increasingly large puzzles (2x20)
 - Search paths, Solution paths and costs became increasingly large (Search path lengths of 14k+ and solution costs of 300+)
 - At 2x30, starts to take a longer time to get a solution