**CMPUT 366 ASSIGNMENT 2**

Chart, line chart

Description automatically generated

The running time is in seconds.

Except for a few outliers, this plot shows that running backtracking with minimum remaining values heuristic for variable selection is significantly faster than using first available variable selection (some instances can be faster up to a factor of hundreds).

The reason for this is because by choosing the variables with the smallest domain, we will likely reduce the size of the search tree (reducing branching factor) (note that in the Backtracking algorithm, we have to loop through every single value of the domain at that node).

In summary, minimum remaining values heuristic tries to prove a partial assignment to be unsolvable as quickly as possible if the partial assignment cannot lead to a solution, meanwhile it will try to find a solution as quickly as possible if the partial assignment can lead to a solution.

In first assignment backtracking algorithm, even though selecting variable using first assignment algorithm is faster than using minimum remaining value algorithm (in the minimum remaining value algorithm, we have to search every single cells, meanwhile first assignment will only loop until it find any unassigned cell), this in turn making the selected variable using first assignment algorithm is not as ideal as the one in the minimum remaining value algorithm, hence the branching factor of the search tree is larger, thus slower. It’s a trade of, but using the minimum remaining value backtracking is better since the cost of increasing the branch factor in the search tree is far outweighed the cost of just searching at most cells at a time (which is very cheap in terms of time complexity) for each time we select an unassigned cell.

\*\* Note that in the file , I create versions of backtracking algorithm. The first version is in the method of class, where I implement the backtracking algorithm without inference. Also in the same class, I created another method called , where I implement the backtracking algorithm inference.