SUDOKU SOLVER IN C++ USING BACKTRACKING

An investigatory course project in the subject of Introduction To Algorithms (IC3025) undertaken by

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What is Backtracking?

Backtracking is a generalized path finding algorithm which can be applied to a constrained problem, which systematically explores a given path until either a solution is obtained, or an end is reached, at which point it will retrace its steps and make a different path choice at the closest available point.

Sudoku solving using backtracking:

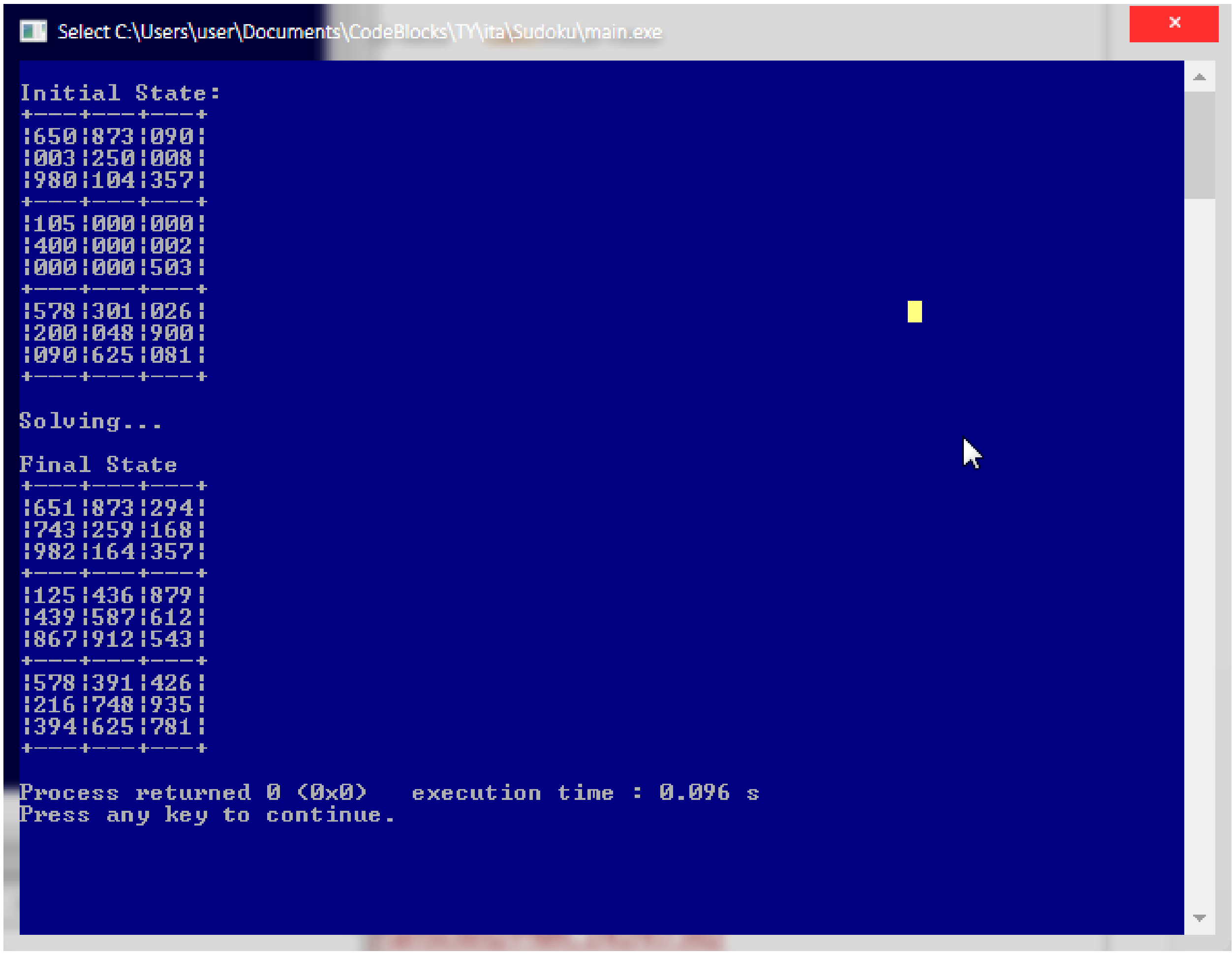
In our particular application, the algorithm works as follows:

1) Locate first Empty Square (denoted by 0).
2) Check the smallest number which can legally be placed in the square
3) If a number is obtained, place it and move on to the next empty square. Else, try a different number.
4) If no number can be legally placed, backtrack to the previous number placed and place a different number in that location and repeat.
5) If no empty squares exist, board is solved.

Efficiency Analysis:

The least number of starting digits a Sudoku puzzle can have (and still have a unique solution) is 17. This means the most empty squares the program will have to solve will be 81. With 9 possible values, the fact that the algorithm does not exclude previously inserted values means that the algorithm will have to check the legality of a number at most 729 (81*9) times.

Code output:


Select C:\Users\user\Documents\CodeBlocks\TY\ita\Sudoku\main.exe

```
Initial State:
+---+---+---+
¦650¦873¦090¦
¦003¦250¦008¦
¦980¦104¦357¦
+---+---+---+
¦105¦000¦000¦
¦400¦000¦002¦
¦000¦000¦503¦
+---+---+---+
¦578¦301¦026¦
¦200¦048¦900¦
¦090¦625¦081¦
+---+---+---+

Solving...

Final State
+---+---+---+
¦651¦873¦294¦
¦743¦259¦168¦
¦982¦164¦357¦
+---+---+---+
¦125¦436¦879¦
¦439¦587¦612¦
¦867¦912¦543¦
+---+---+---+
¦578¦391¦426¦
¦216¦748¦935¦
¦394¦625¦781¦
+---+---+---+

Process returned 0 (0x0)   execution time : 0.096 s
Press any key to continue.
```

Output of main code. Demo code will eventually lead to the same, but will wait for user input between steps to demonstrate the solving process.

References:

https://www.techopedia.com/definition/17837/backtracking

https://en.wikipedia.org/wiki/Backtracking