

National University of Computer & Emerging Sciences Karachi Campus



COAL Project Report: SUDOKU GAME & SOLVER

[Section G]

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Introduction:

Sudoku is based on 9x9 grid with total of eighty-one cells and nine 3x3 sub-boxes. All the cells can be filled with numbers from 1 to 9 only, such that no same number can be present in the same row, same column and same box. In start grid is provided with some filled cells and some left empty and then player is asked to fill the rest of empty cells according to the rules stated above.

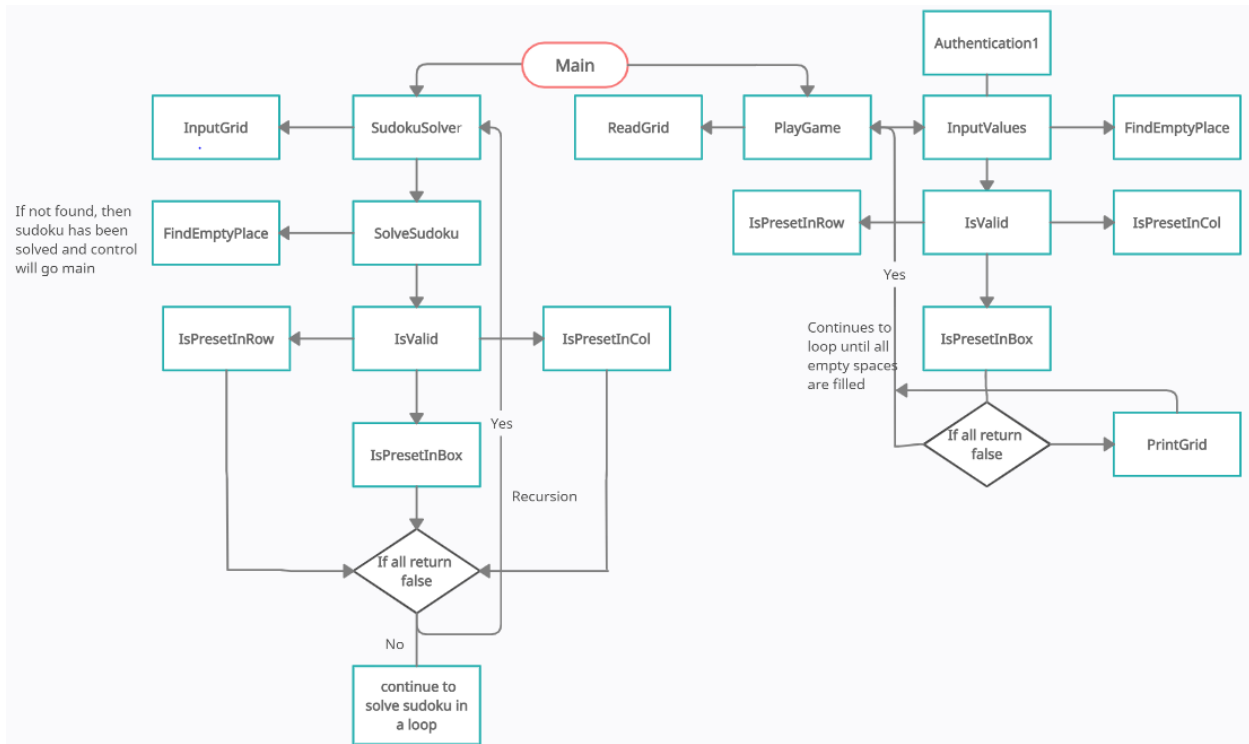
Our project consists of two modules; Sudoku Solver & Sudoku Game.

Methodology:

Sudoku Solver works on recursion/back-tracking principles while fully utilizing the stack. Firstly, an unsolved sudoku is provided by the user then, the program starts filling the empty cells by the numbers b/w 1-9 while also ensuring that the certain number can be placed or not according to the standard sudoku rules. If it cannot find any placeable number within a certain cell then, it back-tracks to the previous cell, change its number & finally proceeds to the next cell.

In *Sudoku Game* Module, the program first reads the unsolved Sudoku Grid from the file randomly & then, let the user to play. The user has to specify the row & column number of the cell in which he/she wants to place the number. The program checks whether the element can be placed or not according to the standard sudoku rules & informs the user. The game continues until all the cells are filled & the score is printed.

Flow Diagram:



Output Screenshots:

Sudoku Solver:

```
-----  
| 0 7 9 | 8 0 0 | 3 0 0 |  
| 0 0 1 | 6 0 0 | 2 0 0 |  
| 5 0 0 | 0 0 0 | 8 7 6 |  
-----  
| 0 1 5 | 0 7 0 | 0 6 0 |  
| 0 0 0 | 0 0 0 | 0 0 0 |  
| 0 0 0 | 0 0 4 | 5 2 8 |  
-----  
| 8 4 0 | 0 0 2 | 0 0 0 |  
| 0 3 0 | 0 5 0 | 1 0 0 |  
| 0 0 0 | 0 0 0 | 0 0 0 |  
-----  
Enter the elements for ROW-9  
0  
0  
0  
7  
0  
0  
6  
9  
0
```

Figure 1: Unsolved Sudoku being entered by the user

```
The solved grid is:  
  
-----  
| 6 7 9 | 8 2 5 | 3 4 1 |  
| 3 8 1 | 6 4 7 | 2 5 9 |  
| 5 2 4 | 3 9 1 | 8 7 6 |  
-----  
| 4 1 5 | 2 7 8 | 9 6 3 |  
| 2 6 8 | 5 3 9 | 4 1 7 |  
| 7 9 3 | 1 6 4 | 5 2 8 |  
-----  
| 8 4 6 | 9 1 2 | 7 3 5 |  
| 9 3 7 | 4 5 6 | 1 8 2 |  
| 1 5 2 | 7 8 3 | 6 9 4 |  
-----  
  
ENTER ANY KEY TO GO BACK TO THE MAIN MENU.....
```

Figure 2: After Program Solved the Sudoku

Sudoku Game:

```
-----  
| 0 0 0 | 2 6 0 | 7 0 1 |  
| 6 8 0 | 0 7 0 | 0 9 0 |  
| 1 9 0 | 0 0 4 | 5 0 0 |  
-----  
| 8 2 0 | 1 0 0 | 0 4 0 |  
| 0 0 4 | 6 0 2 | 9 0 0 |  
| 0 5 0 | 0 0 3 | 0 2 8 |  
-----  
| 0 0 9 | 3 0 0 | 0 7 4 |  
| 0 4 0 | 0 5 0 | 0 3 6 |  
| 7 0 3 | 0 1 8 | 0 0 0 |  
-----
```

Enter the row no: 1

Enter the column no: 1

Enter the value: 3

```
-----  
| 3 0 0 | 2 6 0 | 7 0 1 |  
| 6 8 0 | 0 7 0 | 0 9 0 |  
| 1 9 0 | 0 0 4 | 5 0 0 |  
-----  
| 8 2 0 | 1 0 0 | 0 4 0 |  
| 0 0 4 | 6 0 2 | 9 0 0 |  
| 0 5 0 | 0 0 3 | 0 2 8 |  
-----  
| 0 0 9 | 3 0 0 | 0 7 4 |  
| 0 4 0 | 0 5 0 | 0 3 6 |  
| 7 0 3 | 0 1 8 | 0 0 0 |  
-----
```

Figure 3: Correct number being entered by the user

```

-----
| 3 0 0 | 2 6 0 | 7 0 1 |
| 6 8 0 | 0 7 0 | 0 9 0 |
| 1 9 0 | 0 0 4 | 5 0 0 |
-----
| 8 2 0 | 1 0 0 | 0 4 0 |
| 0 0 4 | 6 0 2 | 9 0 0 |
| 0 5 0 | 0 0 3 | 0 2 8 |
-----
| 0 0 9 | 3 0 0 | 0 7 4 |
| 0 4 0 | 0 5 0 | 0 3 6 |
| 7 0 3 | 0 1 8 | 0 0 0 |
-----

```

Enter the row no: 1
Enter the column no: 2
Enter the value: 6

This is an INVALID VALUE!

```

-----
| 3 0 0 | 2 6 0 | 7 0 1 |
| 6 8 0 | 0 7 0 | 0 9 0 |
| 1 9 0 | 0 0 4 | 5 0 0 |
-----
| 8 2 0 | 1 0 0 | 0 4 0 |
| 0 0 4 | 6 0 2 | 9 0 0 |
| 0 5 0 | 0 0 3 | 0 2 8 |
-----
| 0 0 9 | 3 0 0 | 0 7 4 |
| 0 4 0 | 0 5 0 | 0 3 6 |
| 7 0 3 | 0 1 8 | 0 0 0 |
-----

```

Figure 4: Invalid number being entered by the user

Conclusion:

Sudoku Solver will take unsolved sudoku grid from the user & solve it with the help of back-tracking algorithm. Whereas, Sudoku Game reads the unsolved Sudoku & then, lets the user solve it. It also calculates the score in the end.