



MANIPAL INSTITUTE OF TECHNOLOGY

SUDOKU SOLUTION VALIDATOR

CSE 3163 Operating System Lab
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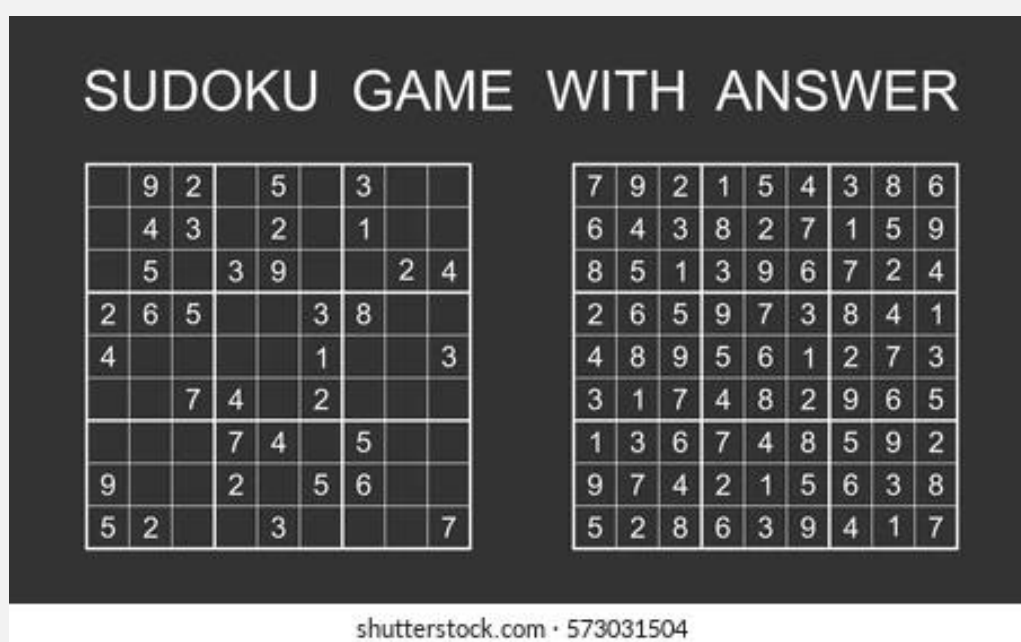
Mrs. Archana P Kumar

Table of Contents

<u>Topic</u>		<u>Page.No.</u>
Introduction	-	3
Approach and Methodology	-	4
Test Results	-	5
Conclusion	-	6

Introduction

Sudoku is a logic-based, combinatorial number-placement puzzle. In classic Sudoku, the objective is to fill a 9 x 9 grid with digits so that each column, each row, and each of the nine 3 x 3 sub grids that compose the grid contain all the digits from 1 to 9.



We can clearly see that checking the validity of solutions of such many Sudoku games in a short time is not an easy task.

Approach and Methodology

We are applying the concept of multithreading in this project.

Multithreading allows the execution of multiple parts of a program at the same time. These parts are known as threads and are lightweight processes available within the process. So multithreading leads to maximum utilization of the CPU by multitasking.

To achieve this, we created 27 threads in total

- 9 threads for all the 3x3 sub grids (thread_0 to thread_8)
- 9 threads for all the rows (thread_9 to thread_17)
- 9 threads for all the columns (thread_18 to thread_26)

Also, we created a one-dimensional array of size 27, initialized to 0, which stores the integer value of 1 in the corresponding index of the thread if that thread finds no mistake on checking.

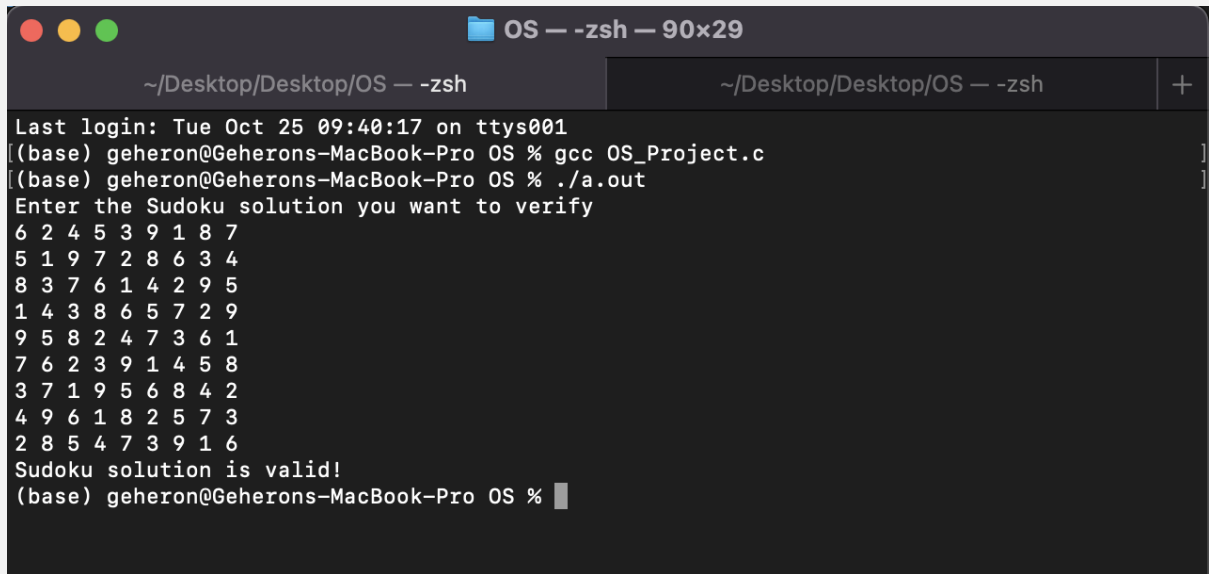
At the end, we check if all the values of the validity array are 1. If all of them are found to be 1, then the solution entered is valid, else the solution entered is invalid.

The solution table of the Sudoku will be taken from the user as input. The user must enter 9x9 numbers, consisting of only 1 to 9, which will be processed and validated by our program.

Test Results

Test Case 1:

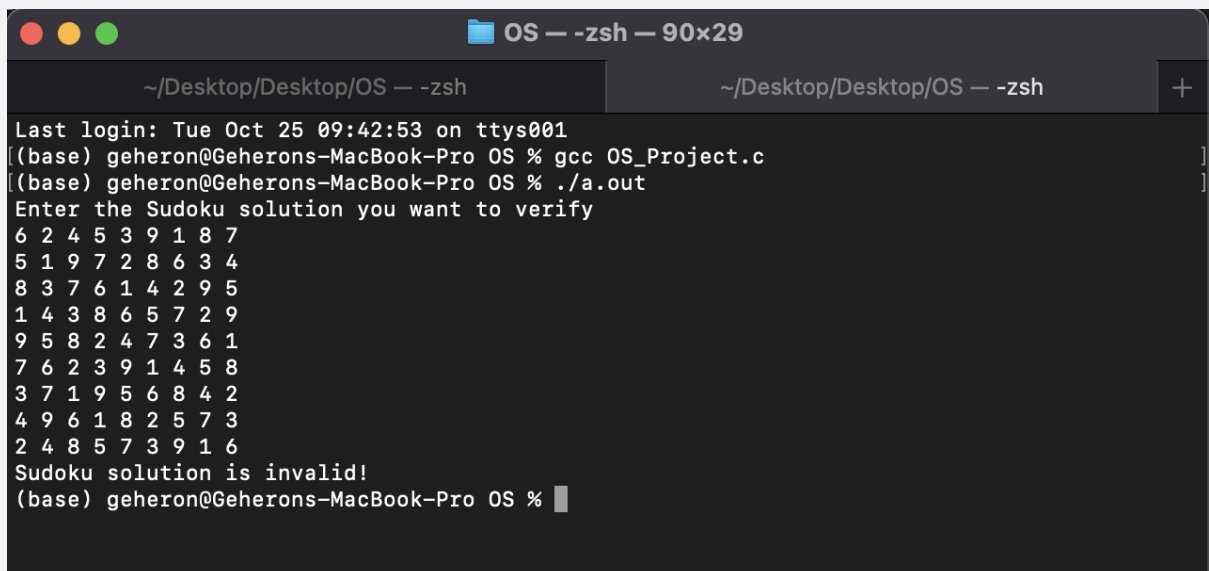
(Valid solution)



```
OS — -zsh — 90x29
~/Desktop/Desktop/OS — -zsh
Last login: Tue Oct 25 09:40:17 on ttys001
(base) geheron@Geherons-MacBook-Pro OS % gcc OS_Project.c
(base) geheron@Geherons-MacBook-Pro OS % ./a.out
Enter the Sudoku solution you want to verify
6 2 4 5 3 9 1 8 7
5 1 9 7 2 8 6 3 4
8 3 7 6 1 4 2 9 5
1 4 3 8 6 5 7 2 9
9 5 8 2 4 7 3 6 1
7 6 2 3 9 1 4 5 8
3 7 1 9 5 6 8 4 2
4 9 6 1 8 2 5 7 3
2 8 5 4 7 3 9 1 6
Sudoku solution is valid!
(base) geheron@Geherons-MacBook-Pro OS %
```

Test Case 2:

(Invalid solution)



```
OS — -zsh — 90x29
~/Desktop/Desktop/OS — -zsh
Last login: Tue Oct 25 09:42:53 on ttys001
(base) geheron@Geherons-MacBook-Pro OS % gcc OS_Project.c
(base) geheron@Geherons-MacBook-Pro OS % ./a.out
Enter the Sudoku solution you want to verify
6 2 4 5 3 9 1 8 7
5 1 9 7 2 8 6 3 4
8 3 7 6 1 4 2 9 5
1 4 3 8 6 5 7 2 9
9 5 8 2 4 7 3 6 1
7 6 2 3 9 1 4 5 8
3 7 1 9 5 6 8 4 2
4 9 6 1 8 2 5 7 3
2 4 8 5 7 3 9 1 6
Sudoku solution is invalid!
(base) geheron@Geherons-MacBook-Pro OS %
```

Conclusion

1. Programming problems can be solved faster by using the concept of multithreading.
2. Multithreading increases CPU utilization in multicore systems of modern computers.
3. This program can be used in building Sudoku game software as well as online Sudoku games to check the validity of the solution entered by a player in a short time.