

USER MANUAL

SUDOKU AUTO-SOLVER

Contents

| | |
|--------------------------------------|----|
| Overview | 2 |
| Instructions for use | 3 |
| (i)General guidelines | 3 |
| (ii)Giving input to the application | 4 |
| (iii)Detailed description of options | 7 |
| (iv)Giving inputs for jigsaw sudoku | 9 |
| Appendix I: Sudoku and its variants | 13 |
| Appendix II: Glossary | 16 |
| Project team | 16 |

Overview

Sudoku Auto-Solver is an application that can solve Sudokus of any degree of toughness as desired by the user.

Our program can also solve its variants like diagonal sudoku, window sudoku and jigsaw sudoku. It can also be used to check solutions if desired by the user.

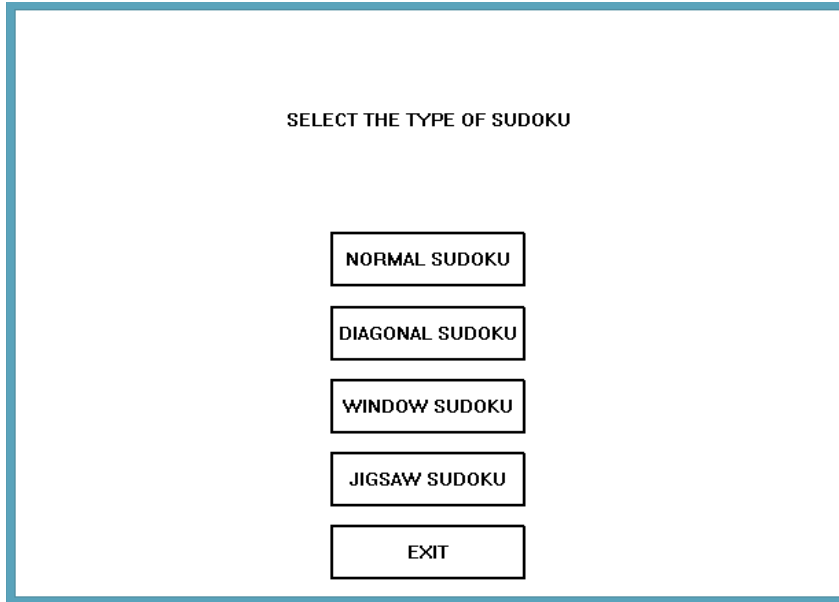
This manual aims to provide the user with a detailed description of the application and the general guidelines and instructions of use.

Instructions for use

(i) General guidelines

- As soon as the user runs the application, the user is provide with two options which are:
 1. START GAME
 2. EXIT

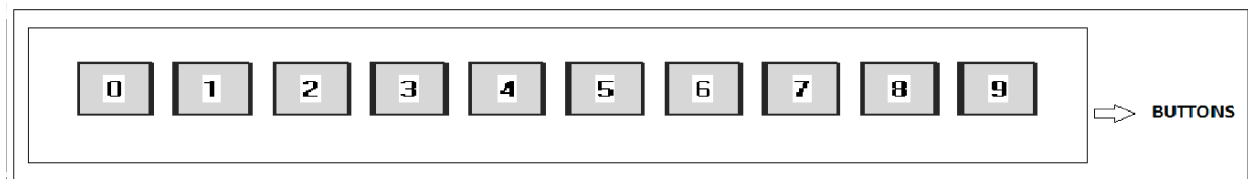
- To continue,click the START GAME button.
- Then a number of options appear and the user is asked to select the desired variant of sudoku that he wishes to solve.
- These options are:
 1. NORMAL SUDOKU
 2. DIAGONAL SUDOKU
 3. WINDOW SUDOKU
 4. JIGSAW SUDOKU
 5. EXIT



- The user can then click on the corresponding button to select the desired variant or click EXIT to quit the application.

(ii) Giving input to the application

- Here detailed description of how to input the elements for a sudoku is given.
- The description uses an illustration involving Normal sudoku.
- Note that the same procedure is applicable for all other variants.
- After selecting the type of sudoku, the user has to input the elements of the Sudoku.
- For giving the input a series of buttons numbered 0 to 9 is provided at the bottom as shown below.



- As soon as you click a specific button, its corresponding number is displayed on the tile that is to be entered.
- The input must be given in the following manner:
 - The known elements are entered by clicking on desired digits.
 - The blanks are entered as zeros.

- First you have to start entering the elements from the first row and first column.
- Then proceed to the element in first row and second column and so on.
- After completing a row proceed with the next row starting from the first column and repeat the process till the end.
- For instance, let the first three entries of the first row are 5, empty and 4 respectively .
- Input the first element 5. Then “5” will be displayed on the tile corresponding to first row and first column.
- Then click on the button “0”. (since the second element is blank) .
- Then click on the button “4” and continue further.
- At intermediate stages of filling the layout may look something like the illustrations shown below for the case of normal Sudoku.
- The final layout is also shown below.

Give the Input For The Sudoku,'0' for blank.

| | | | | | | | | | |
|---|---|---|---|---|---|--|--|--|--|
| 5 | 0 | 4 | 6 | 0 | 9 | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

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

Give the Input For The Sudoku,'0' for blank.

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

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

Give the Input For The Sudoku. '0' for blank.

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

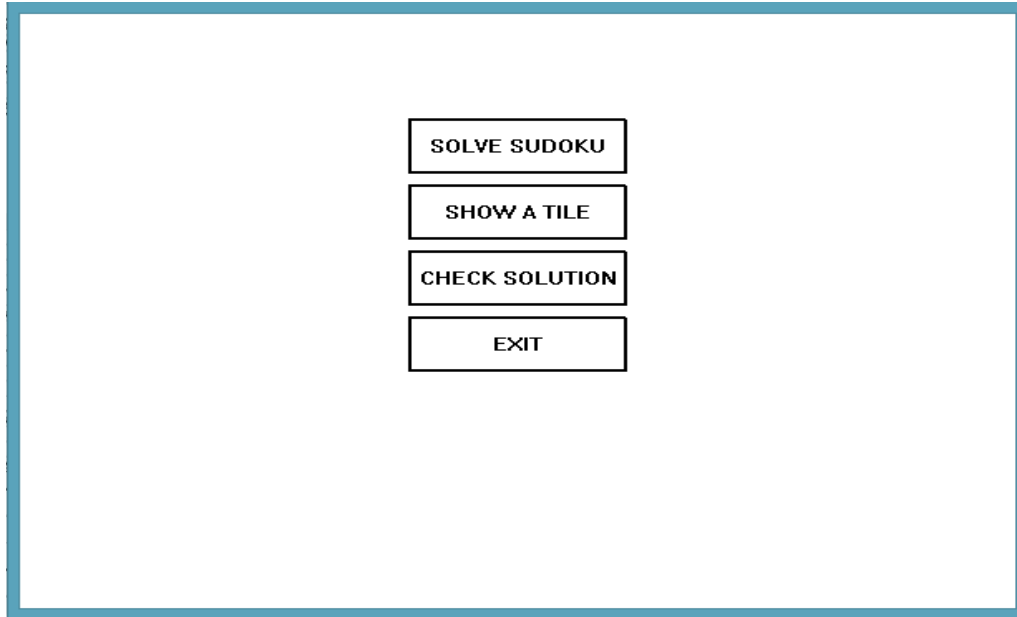
Input

0 1 2 3 4 5 6 7 8 9

- Click the “Input” button present to the right of the window depicted above to continue.

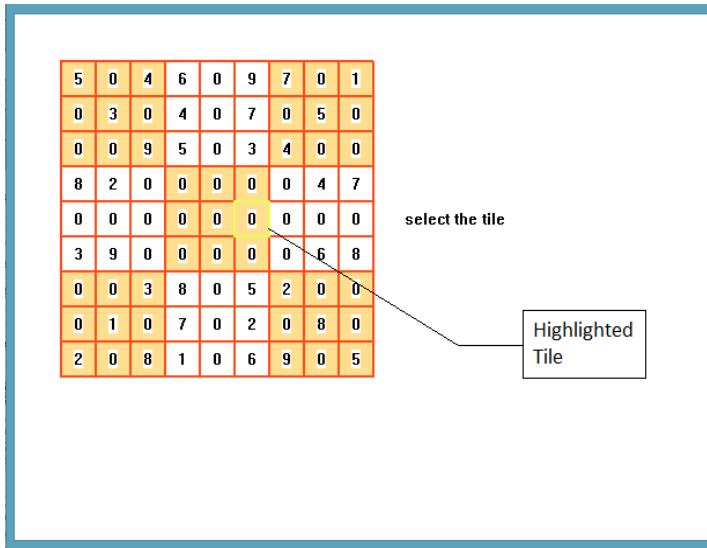
Input

- Please note that the input provided must be valid, i.e. it must comply with basic requirements of corresponding Sudoku variant. Otherwise the Sudoku is rejected on grounds of invalid input and an error message showing “Invalid Input” appears on screen.
- Then another choice box appears on the screen asking the user what he wishes to do. The user has to choose one of the following options:
 - Solve Sudoku
 - Show a Tile
 - Check Solution
 - Exit

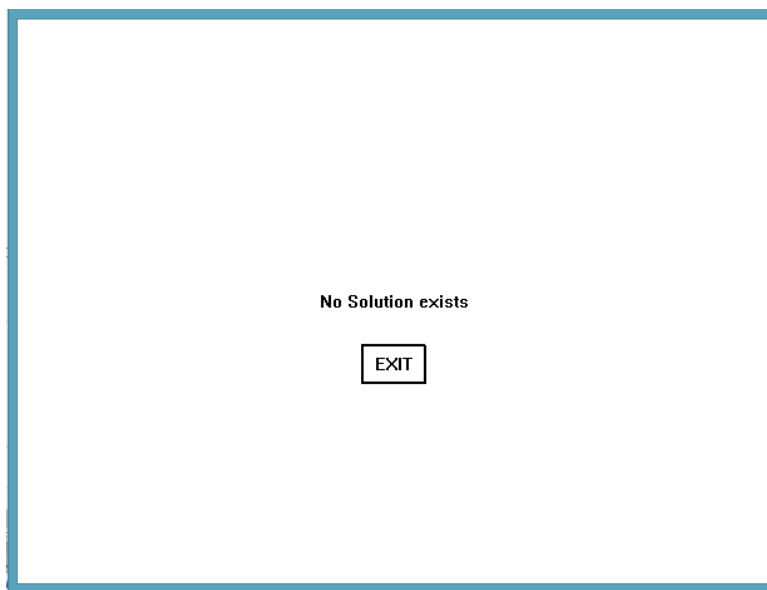


(iii) Detailed description of the options

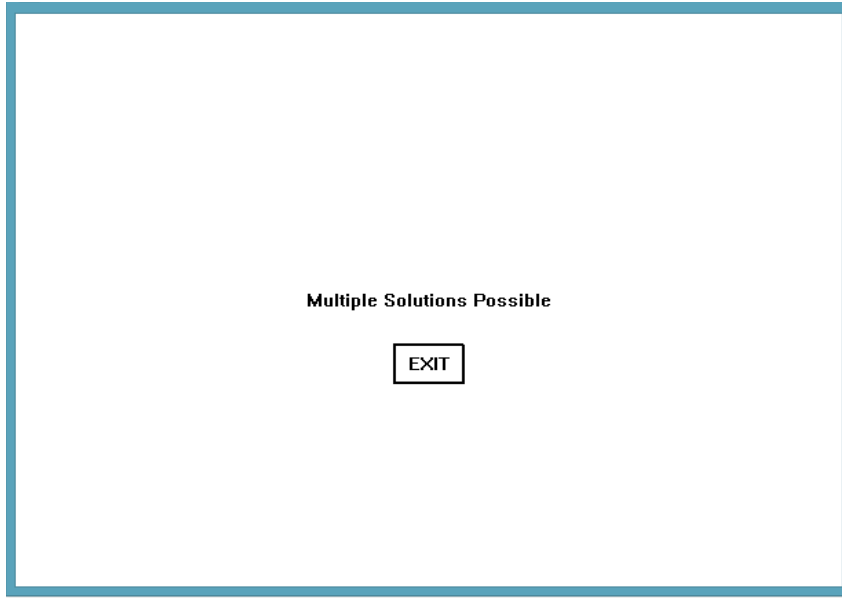
- These options are programmed accordingly so as to meet various interests of the users.
- Solve Sudoku
 - This option solves the Sudoku.
 - If the given input is valid and there is a solution, then the solution Sudoku is printed.
 - The program also indicates whether the sudoku possess a unique solution or not.
 - While if there is no solution, the message "No Solution Exists" is displayed on the screen.
 - The application can now be terminated by clicking on "EXIT" button.
- Show a Tile
 - If the user wishes to solve the Sudoku by himself but is stuck at some point and he can use this option to view the digit corresponding to a particular tile as a hint.
 - The program then asks the user to select the tile that he wishes to see.
 - The user can select the tile by clicking on it. The tile gets highlighted as soon as this is done.



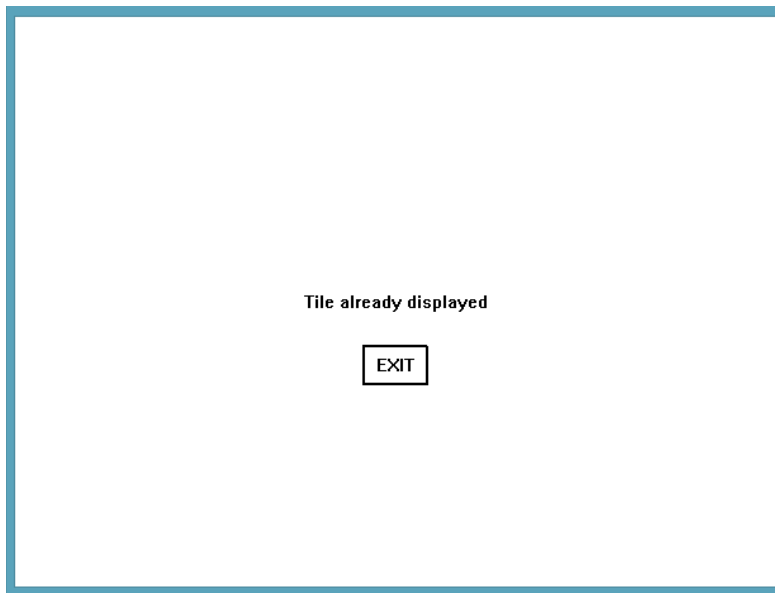
- o If the sudoku does not possess a solution, then the program displays the message:“No solution exists”.



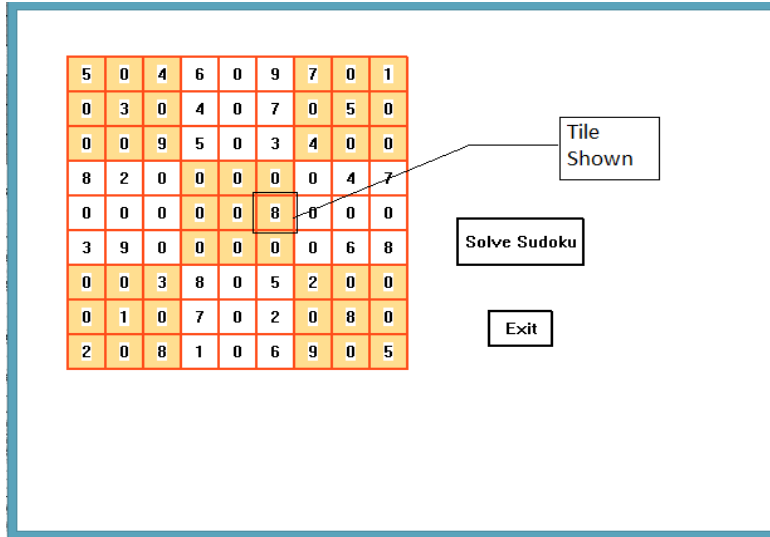
- o If the sudoku does not possess a unique solution, then the program displays the message:“Multiple solutions possible”.



- o If tile selected is already filled, then the program displays the message: "Tile already displayed".



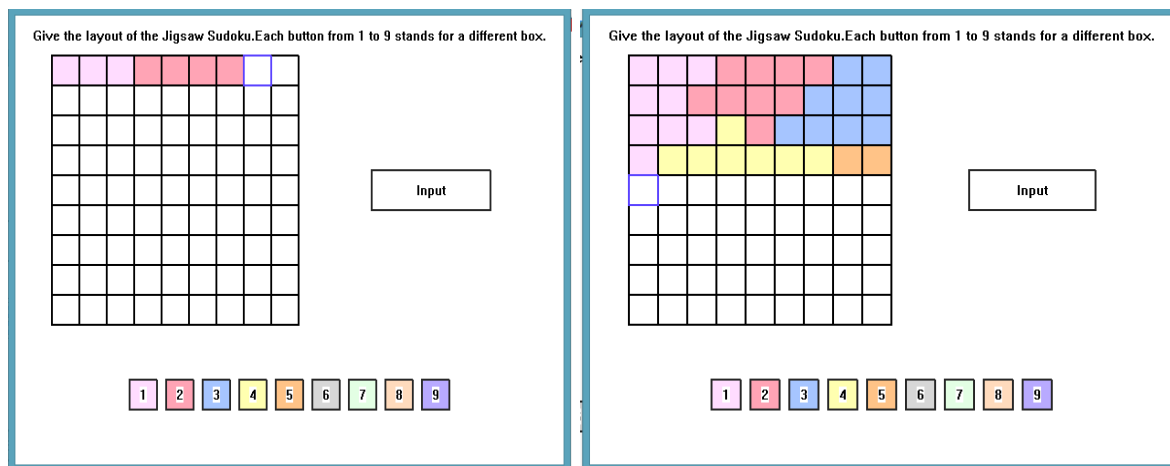
- o If a blank tile is selected and the sudoku possess a unique solution, then the number in the corresponding tile gets displayed along with the complete grid.

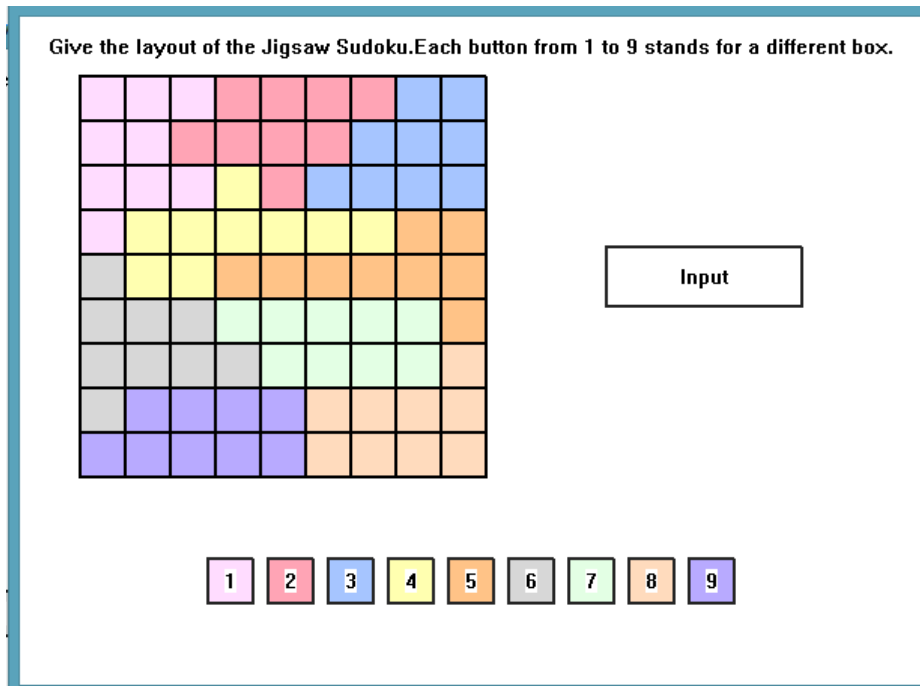


- A choice box then appears on the screen asking the user to choose one of the following:
 1. Solve Sudoku
 2. Exit
- Check Solution
 - This option can be used if the user wishes to check his solution to the Sudoku that he has solved.
 - The application then asks the user to enter his solution.
 - The solution must be entered in the same manner as specified above to enter the Sudoku puzzle.
 - If the solution has any blank box, then the message “Solution is Incomplete” is displayed.
 - If the solution is incorrect the message “Solution is Incorrect” is displayed.
 - If the solution is correct the message “Solution is Correct” is displayed.
 - The application can now be terminated by clicking on “EXIT” button.
- Exit
 - If the user wishes to exit the program, then he can select this option.
 - The application will get terminated by itself.

(iv) Giving inputs for jigsaw Sudoku

- Jigsaw Sudoku is slightly different in appearance as compared to the other variants.
- The major difference from the other types is that the layout of the boxes in this sudoku are not pre-decided.
- If the Jigsaw Sudoku option is selected initially, then the input process is somewhat different from that mentioned above for other variants.
- First the user has to input the layout for the boxes.
- The procedure for giving the layout is similar to giving input of the elements which is described above. However, the difference here is that instead of digits colours appear on the tiles. Further as there is no tile without a color and there is no “0” button in this case.
- A highlighter is provided to indicate the next tile to be filled.
- At intermediate stages of filling the layout may look something like the illustrations shown below.
- The final layout is also shown after which the user has to click on “Input” button.





- A detailed explanation on the above procedure is given below. However it can be skipped without breaking the continuity of the text
 - The different boxes are represented by different colors. Each button stands for a different color and hence corresponds to a nine-tile box.
 - In order to input the layout for the boxes of the Jigsaw Sudoku the user has to click on a button for each tile.
 - The order for filling the tiles is the same for other inputs.
 - After providing the complete layout click on “input” button at the right to continue.
- Note that the layout would be valid only if for each tile, atleast one of the four adjacent tiles is of the same color and each box must have exactly nine tiles.
- If above conditions are not satisfied then input is rejected and “INVALID INPUT” is displayed on the screen.
- The procedure to input the digits is similar to that of the other variants.
- At intermediate stages of filling the layout may look something like the illustrations shown below.

- The final layout is also shown after which the user has to click on “Input” button.

Give the Input For The Sudoku('0' for blank)

| | | | | | | | | | |
|---|---|---|---|---|---|---|--|--|--|
| 0 | 1 | 0 | 2 | 0 | 0 | 7 | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Input

0

1

2

3

4

5

6

7

8

9

Give the Input For The Sudoku('0' for blank)

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

Input

0

1

2

3

4

5

6

7

8

9

Give the Input For The Sudoku('0' for blank)

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

Input

0

1

2

3

4

5

6

7

8

9

- If the input is invalid appropriate error message is displayed on the screen.
- Otherwise the same choice box appears on the screen asking the user to choose one of the following options:
 1. Solve Sudoku

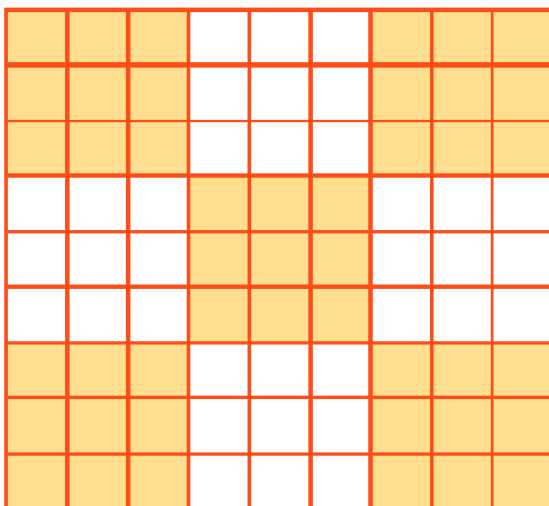
2. Give the number in a specified tile
3. Check Solution
4. Exit

Appendix I: Sudoku and its variants

(Note that all illustrations in this section are taken from the application itself)

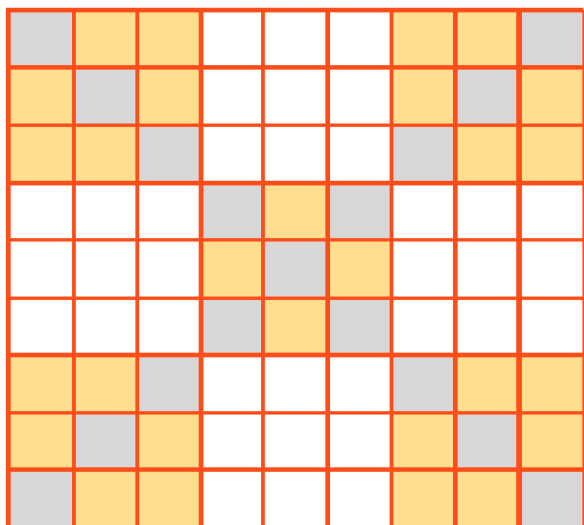
NORMAL SUDOKU:

It is the well-known, original Sudoku. It is played on a 9x9 grid each element of which is called a tile, divided to 3x3 sub grids or boxes. The objective is to fill a grid with digits so that each column, each row, and each of the nine boxes that compose the grid contains all of the digits from 1 to 9 and each digit appears only once.



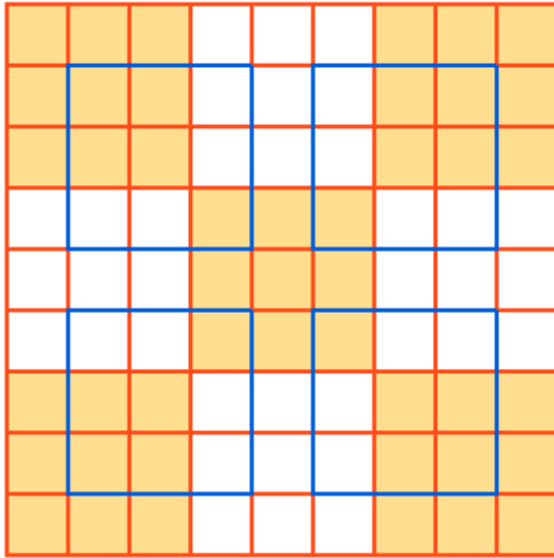
DIAGONAL SUDOKU:

Diagonal Sudoku is also played over a 9x9 grid divided to 3x3 sub grids or boxes. The objective is same as Sudoku. However, the main diagonals of the grid also contains all of the digits from 1 to 9 and each digit appears once.



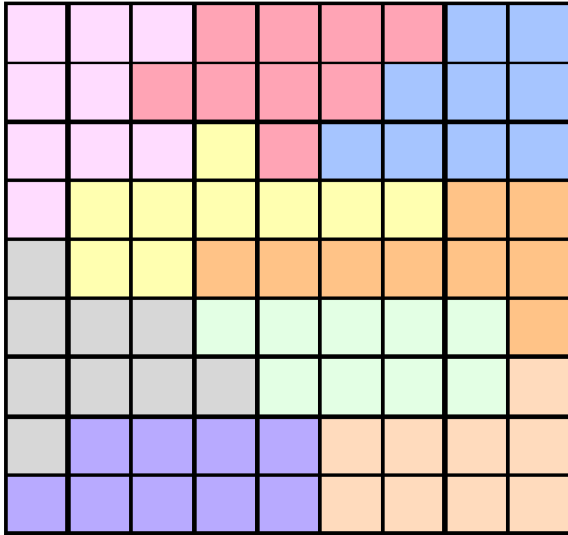
WINDOW SUDOKU:

Window Sudoku is also played over a 9x9 grid divided to 3x3 sub grids or boxes. The objective is same as Sudoku. However, there are four additional boxes in the grid that also contain all of the digits from 1 to 9 and each digit appears once.



JIGSAW SUDOKU:

Jigsaw Sudoku is also played over a 9x9 grid, divided to nine irregular shaped sub grids or boxes of 9 tiles each. The objective is to fill a grid with digits so that each column, each row, and each of the nine irregular boxes that compose the grid contains all of the digits from 1 to 9 and each digit appears once.



Appendix II: Glossary

| Term | Definition |
|-------------|---|
| Sudoku | A logic-based,combinatorial number -placement puzzle. The objective is to fill a 9×9 grid with digits so that each column, each row, and each of the nine 3×3 sub-grids that compose the grid contains all of the digits from 1 to 9. |
| Auto-solver | A program that can solve a given problem without any other human input except for the problem statement. |
| Box | A 3×3 sub-grid that composes the main grid. Each digit must appear once in a box. |

| | |
|-------|---|
| Tile | A single element of the 9×9 grid. It contains only one digit. |
| Input | An entrance or change that is given to a system and which activate or modify a process. |
| User | Person handling the program. |

Project team

| | |
|--------------------|-----------|
| B Chaitanya Rajesh | 140050073 |
| Chitraang Murdia | 140050023 |
| K V N Sreenivasulu | 140050078 |

Slot: 11

Group: 11