The Sudoku Puzzle

Computer Science Project Synopsis

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Aim:
To create a sudoku puzzle game with GUI for the user to solve.

Description:
Sudoku is one of the most popular puzzle games of all time. The goal of Sudoku is to fill a 9×9 grid with numbers so that each row, column and 3×3 section contain all of the digits between 1 and 9.

At the beginning of the game, the 9×9 grid will have some of the squares filled in. The user's job is to use logic to fill in the missing digits and complete the grid.

A move is incorrect if:
- Any row contains more than one of the same number from 1 to 9
- Any column contains more than one of the same number from 1 to 9
- Any 3×3 grid contains more than one of the same number from 1 to 9

Implementation:
The project implementation is divided into the following four groups:

1) Design

    - **Grid**
      A sudoku grid consists of 9 boxes, each consisting of 3x3 grids. Each cell in the grid either has a number or is empty. Some numbers are already present while others are entered by the user.

    - **Black numbers**
      These numbers are already present in the sudoku grid before the user has begun the game and are black in colour. These values are fixed and cannot be changed by the user.

    - **Blue numbers**
      These numbers are entered by the user in the empty spaces of the sudoku grid and are blue in colour.

    - **Red numbers**
      If and when the numbers entered by the user do not satisfy the rules of the game, they will appear red in colour to indicate this to the user.

2) Checks

- **Row**
  A number between 1 and 9 cannot appear twice in the same row, otherwise it will appear as red as it does not follow the rules of the game.

- **Column**
  Similarly, a number cannot appear twice in a column.

- **Box**
  A box can also only contain numbers from 1 to 9 occurring once in each box.

- **Win**
  A sudoku is considered to be solved only when no empty spaces are remaining in the grid and all the rows, columns and boxes contain all the numbers from 1 to 9 without repetition.

3) User Input

- **Numbers Entry**
  These numbers will be entered by the user through a button keypad provided on the screen after selecting the position on the grid.
  They will enter these values following the rules of the games using their logic and deductive reasoning abilities. If they enter a number which goes against the rules of the game it will appear red and if not, then it will appear blue.

- **Erase**
  This feature will allow the user to erase or remove the values entered by them in case they enter a ‘red value’ or if they simply change their mind about the position of a number.
  It is important to note that the user cannot erase the black numbers.

- **Reset**
  This feature will allow the user to erase all the values input by them and return to the original board.

4) Storage
    - **Original Grid**
      This is a 9x9 Matrix representing the initial state of the puzzle. This is the problem that is to be solved. The values (black numbers only) in this cannot be manipulated by the user.

    - **Current Grid**
      This is a 9x9 Matrix representing the current state of the puzzle. This includes both black and blue numbers. When erasing values, the user can only erase the values that are present in this grid and not in the original grid.