Architecture of Sodoku Solver

Algorithm:-

1. As the sudoku solver is an NP-complete problem so there does not exist any Polynomial time algorithm to solve this problem. So, the final choice of algorithm is **BackTracking.**

Language:-

1. Python is the language to solve this problem, as it is easy to implement and platform-independent.

Issue:-

1. As this is an NP-complete problem, first I tried the Naive(Brute force) approach. In which I am filling empty positions on the board with numbers and checking if the board is correct or not. Below is the Naive algorithm.

```
Solve(board) {

      for(num = 1 -> 9) {
            row, col = getEmptyPositions(board)

            if(row == -1 and col == -1) {
                  return isValid(board);
            }

            board[row][col] = num

            result = result or solve(board)

            if(result == true) {
                  return true;
            }

            board[row][col] = 0
      }

      return result
}
```

Optimizations:- (Reducing number of recursive calls)

From the above, we can see we're trying for every number in the empty position when the board is full then we are checking if the board is correct or not.

Instead of the above what we can do is restrict the numbers we can place in every column by first checking if placing the number is valid or not. This can reduce the number of recursive calls. Below is the algorithm for this approach.

```
Solve(board) {

      for(num = 1 -> 9) {
            row, col = getEmptyPositions(board)

            if(row == -1 and col == -1) {
                  return true;
            }

            board[row][col] = num

            result = false;

            if(isValid(board)) {
                  result = result or solve(board)
            }

            if(result == true) {
                  return true;
            }

            board[row][col] = 0
      }

      return result
}
```

From the above, we can see we are reducing the number of recursive calls, by calling when the number placed in the board is valid.