In [1]:
```python
# 1. Import the Necessary Modules

from typing import List, Tuple, Optional
```

In [2]:
```python
# 2. Define the Constants

# Size constants
N = 9
digits = set(str(i) for i in range(1, 10))
```

In [3]:
```python
# 3. Helper functions

def is_valid(board: List[List[str]], row: int, col: int, num: str) -> bool:
    block_row, block_col = 3 * (row // 3), 3 * (col // 3)
    for i in range(9):
        if board[row][i] == num or board[i][col] == num:
            return False
    for i in range(3):
        for j in range(3):
            if board[block_row + i][block_col + j] == num:
                return False
    return True

def find_empty(board: List[List[str]]) -> Optional[Tuple[int, int]]:
    for i in range(9):
        for j in range(9):
            if board[i][j] == '.':
                return (i, j)
    return None
```

In [4]:
```python
# 4. Backtracking CSP Solver

def solve_sudoku(board: List[List[str]]) -> bool:
    empty = find_empty(board)
    if not empty:
        return True  # Puzzle solved

    row, col = empty
    for num in map(str, range(1, 10)):
        if is_valid(board, row, col, num):
            board[row][col] = num
            if solve_sudoku(board):
                return True
            board[row][col] = '.'  # Backtrack
    return False
```

In [5]:
```python
# 5. Pretty print function

def print_board(board: List[List[str]]):
    for i in range(9):
        print(" ".join(board[i]))
```

In [6]:
```python
# 6. Definig The Sudoku

# Sample Sudoku puzzle ('.' denotes empty cells)
sudoku_board = [
    ['5', '3', '.', '.', '7', '.', '.', '.', '.'],
```

```
    ['6', '.', '.', '1', '9', '5', '.', '.', '.'],
    ['.', '9', '8', '.', '.', '.', '.', '6', '.'],
    ['8', '.', '.', '.', '6', '.', '.', '.', '3'],
    ['4', '.', '.', '8', '.', '3', '.', '.', '1'],
    ['7', '.', '.', '.', '2', '.', '.', '.', '6'],
    ['.', '6', '.', '.', '.', '.', '2', '8', '.'],
    ['.', '.', '.', '4', '1', '9', '.', '.', '5'],
    ['.', '.', '.', '.', '8', '.', '.', '7', '9']
]

print("Initial Sudoku Board:")
print_board(sudoku_board)
```

```
Initial Sudoku Board:
5 3 . . 7 . . . .
6 . . 1 9 5 . . .
. 9 8 . . . . 6 .
8 . . . 6 . . . 3
4 . . 8 . 3 . . 1
7 . . . 2 . . . 6
. 6 . . . . 2 8 .
. . . 4 1 9 . . 5
. . . . 8 . . 7 9
```

In [7]:
```
# 7. Solving the Sudoku

solve_sudoku(sudoku_board)
print("\nSolved Sudoku Board:")
print_board(sudoku_board)
```

```
Solved Sudoku Board:
5 3 4 6 7 8 9 1 2
6 7 2 1 9 5 3 4 8
1 9 8 3 4 2 5 6 7
8 5 9 7 6 1 4 2 3
4 2 6 8 5 3 7 9 1
7 1 3 9 2 4 8 5 6
9 6 1 5 3 7 2 8 4
2 8 7 4 1 9 6 3 5
3 4 5 2 8 6 1 7 9
```