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1 class NQBacktracking:
2     def __init__(self, x_, y_):
3         """self.ld is an array where its indices indicate row-col+N-1
4         (N-1) is for shifting the difference to store negative indices"""
5         self.ld = [0] * 30
6
7         """ self.rd is an array where its indices indicate row+col and used
8         to check whether a queen can be placed on right diagonal or not"""
9         self.rd = [0] * 30
10
11        """column array where its indices indicates column and
12        used to check whether a queen can be placed in that row or not"""
13        self.cl = [0] * 30
14
15        """Initial position of 1st queen"""
16        self.x = x_
17        self.y = y_
18
19    def printSolution(self, board):
20        """A utility function to print solution"""
21        print(
22            "N Queen Backtracking Solution:\nGiven initial position of 1st queen at row:",
23            self.x,
24            "column:",
25            self.y,
26            "\n",
27        )
28        for line in board:
29            print(" ".join(map(str, line)))
30
31    def solveNQUtil(self, board, col):
32        """A recursive utility function to solve N
33        Queen problem"""
34
35        # base case: If all queens are placed then return True
36        if col ≥ N:
37            return True
38
39        # Overlook the column where 1st queen is placed
40        if col == self.y:
41            return self.solveNQUtil(board, col + 1)
42
43        for i in range(N):
44            # Overlook the row where 1st queen is placed
45            if i == self.x:
46                continue
47            # Consider this column and try placing
48            # this queen in all rows one by one
49
50            # Check if the queen can be placed on board[i][col]
51            # A check if a queen can be placed on board[row][col].
52            # We just need to check self.ld[row-col+n-1] and self.rd[row+coln]
53            # where self.ld and self.rd are for left and right diagonal respectively
54            if (self.ld[i - col + N - 1] ≠ 1 and self.rd[i + col] ≠ 1) and self.cl[
55                i
56            ] ≠ 1:
57
58                # lace this queen in board[i][col]
59                board[i][col] = 1
60                self.ld[i - col + N - 1] = self.rd[i + col] = self.cl[i] = 1
61

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62         # recur to place rest of the queens
63         if self.solveNQUtil(board, col + 1):
64             return True
65
66         # If placing queen in board[i][col]
67         # doesn't lead to a solution,
68         # then remove queen from board[i][col]
69         board[i][col] = 0 # BACKTRACK
70         self.ld[i - col + N - 1] = self.rd[i + col] = self.cl[i] = 0
71
72         # If the queen cannot be placed in
73         # any row in this column col then return False
74         # print("col:", col, "i:", i, board)
75     return False
76
77 def solveNQ(self):
78     """This function solves the N Queen problem using
79     Backtracking. It mainly uses solveNQUtil() to
80     solve the problem. It returns False if queens
81     cannot be placed, otherwise, return True and
82     prints placement of queens in the form of 1s.
83     Please note that there may be more than one
84     solutions, this function prints one of the
85     feasible solutions."""
86     board = [[0 for _ in range(N)] for _ in range(N)]
87     board[self.x][self.y] = 1
88
89     self.ld[self.x - self.y + N - 1] = self.rd[self.x + self.y] = self.cl[
90         self.x
91     ] = 1
92
93     if not self.solveNQUtil(board, 0):
94         print("Solution does not exist")
95         return False
96     self.printSolution(board)
97     return True
98
99
100 if __name__ == "__main__":
101     N = 8
102     x, y = 3, 2
103
104     NQBt = NQBacktracking(x, y)
105     NQBt.solveNQ()
106
107
108 """
109 OUTPUT:
110
111 N Queen Backtracking Solution:
112 Given initial position of 1st queen at row: 3 column: 2
113
114 1 0 0 0 0 0 0 0
115 0 0 0 0 0 1 0 0
116 0 0 0 0 0 0 0 1
117 0 0 1 0 0 0 0 0
118 0 0 0 0 0 0 1 0
119 0 0 0 1 0 0 0 0
120 0 1 0 0 0 0 0 0
121 0 0 0 0 1 0 0 0
122 """

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