

nQueen

March 5, 2025

1 N-Queen problem

```
[5]: def print_board(board):  
    """Function to print the chessboard in a readable format."""  
    for row in board:  
        print(" ".join("Q" if col else "." for col in row))  
    print("\n")  
  
def is_safe(board, row, col, N):  
    """Check if placing a queen at (row, col) is safe."""  
    # Check column  
    for i in range(row):  
        if board[i][col]:  
            return False  
  
    # Check upper-left diagonal  
    for i, j in zip(range(row, -1, -1), range(col, -1, -1)):  
        if board[i][j]:  
            return False  
  
    # Check upper-right diagonal  
    for i, j in zip(range(row, -1, -1), range(col, N)):  
        if board[i][j]:  
            return False  
  
    return True  
  
def solve_n_queens(board, row, N):  
    """Recursive function to solve N-Queens using backtracking."""  
    if row == N: # Base case: All queens placed  
        print_board(board)  
        return True  
  
    for col in range(N):  
        if is_safe(board, row, col, N):  
            board[row][col] = 1 # Place queen  
            if solve_n_queens(board, row + 1, N): # Recur for next row
```

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        return True
        board[row][col] = 0 # Backtrack

    return False

def n_queens(N):
    """Main function to initialize the board and start solving."""
    board = [[0] * N for _ in range(N)]
    if not solve_n_queens(board, 0, N):
        print("No solution exists.")
    else:
        print("Solution found.")

# Run for N = 1 - 20
for N in range(1, 21):
    print(f"Solving for N = {N}")
    n_queens(N)

```

Solving for N = 1

Q

Solution found.

Solving for N = 2

No solution exists.

Solving for N = 3

No solution exists.

Solving for N = 4

```

. Q . .
. . . Q
Q . . .
. . Q .

```

Solution found.

Solving for N = 5

```

Q . . . .
. . Q . .
. . . . Q
. Q . . .
. . . Q .

```

Solution found.

Solving for N = 6

```

. Q . . . .
. . . Q . .
. . . . . Q

```

```

Q . . . . .
. . Q . . .
. . . . Q .

```

Solution found.
Solving for N = 7

```

Q . . . . .
. . Q . . .
. . . . Q .
. . . . . Q
. Q . . . .
. . . Q . .
. . . . Q .

```

Solution found.
Solving for N = 8

```

Q . . . . .
. . . . Q .
. . . . . Q
. . . . Q .
. . Q . . .
. . . . . Q
. Q . . . .
. . . Q . .

```

Solution found.
Solving for N = 9

```

Q . . . . .
. . Q . . .
. . . . Q .
. . . . . Q
. Q . . . .
. . . Q . .
. . . . . Q
. . . . . Q
. . . . Q .
. . . . Q .

```

Solution found.
Solving for N = 10

```

Q . . . . .
. . Q . . .
. . . . Q .
. . . . . Q
. . . . . Q
. . . . . Q

```

```

. . . . . Q . . . . .
. . . . . . . . . . Q .
. Q . . . . . . . . .
. . . . Q . . . . . .
. . . . . . . Q . . .

```

Solution found.
Solving for N = 11

```

Q . . . . . . . . . .
. . Q . . . . . . .
. . . . . Q . . . . .
. . . . . . . Q . . .
. . . . . . . . . Q .
. . . . . . . . . . Q
. Q . . . . . . . . .
. . . . Q . . . . . .
. . . . . Q . . . . .
. . . . . . . Q . . .
. . . . . . . . . Q .
. . . . . . . . . Q .

```

Solution found.
Solving for N = 12

```

Q . . . . . . . . . .
. . Q . . . . . . .
. . . . . Q . . . . .
. . . . . . . Q . . .
. . . . . . . . . Q .
. . . . . . . . . . Q
. . . . . Q . . . . .
. . . . . . . . . Q .
. Q . . . . . . . . .
. . . . . . . Q . . .
. . . . . . . . . Q .
. . . . Q . . . . . .

```

Solution found.
Solving for N = 13

```

Q . . . . . . . . . .
. . Q . . . . . . .
. . . . . Q . . . . .
. Q . . . . . . . . .
. . . . . . . . . Q .
. . . . . . . . . . Q
. . . . . . . . . Q .
. . . . . . . . . . Q

```

```

. . . Q . . . . .
. . . . . Q . . . . .
. . . . . . Q . . . .
. . . . . . . Q . . .
. . . . . . Q . . . .

```

Solution found.

Solving for N = 14

```

Q . . . . . . . . . .
. . Q . . . . . . . .
. . . . Q . . . . . .
. . . . . Q . . . . .
. . . . . . . Q . . .
. . . . . . . . Q . .
. . . . . . . Q . . .
. . . . . . . . . Q .
. . . Q . . . . . . .
. . . . . . . . . . Q
. . . . . . . Q . . .
. . Q . . . . . . . .
. . . . . Q . . . . .
. . . . . . Q . . . .
. . . . . . . Q . . .

```

Solution found.

Solving for N = 15

```

Q . . . . . . . . . .
. . Q . . . . . . . .
. . . . Q . . . . . .
. . Q . . . . . . . .
. . . . . . . Q . . .
. . . . . . . . Q . .
. . . . . . . . . Q .
. . . Q . . . . . . .
. . . . . . . . Q . .
. . . . . . . Q . . .
. . . . . Q . . . . .
. . . . . . Q . . . .
. . . . . . . . Q . .
. . . . . . . . . Q .
. . . . . Q . . . . .
. . . . . . Q . . . .
. . . . . . . Q . . .

```

Solution found.

Solving for N = 16

```

Q . . . . . . . . . .
. . Q . . . . . . . .

```

Solution found.
Solving for $N = 17$

Solution found.
Solving for $N = 18$

6

Solution found.
Solving for $N = 19$

Solution found.
Solving for $N = 20$

7

```

. . . . . . . . . . . . . . . Q . . . . .
. . . . . . . . . . . . . . . . . . . Q .
. . . . . . . . . Q . . . . . . . . . . .
. . . . . . . . . . . Q . . . . . . . . .
. . . . . . . . . Q . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . Q .
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . Q . . . . .
. . . . . . . . . . . . . . . . . . . . .

```

Solution found.