

# N Queens Problem → Chessboard

board =  $n \times n$  → to place  $n$  queens  
 $n = 4$   $n = 42$

Q	Q	Q	
Q	Q	Q	Q
Q	Q	Q	
	Q		Q

Queens must not attack each other.

$n$  Queens →  $n$  Rows

$Q_1, Q_2, Q_3, Q_4$

$Q_1$				$Q_1$				$Q_1$											
	$Q_2$				$Q_2$				$Q_2$										
		$Q_3$				$Q_3$				$Q_3$									
			$Q_4$				$Q_4$				$Q_4$								


$r-2$			
$r-1$			
$r$			
$r+1$			
$r+2$			

$r-2$			
$r-1$			
$r$			
$r+1$			
$r+2$			

$O(n!)$

$(n-1)$   
 $(n-2)$   
 $(n-3)$

```
void nQueens(board[n][n], row,
             n, ans) {
    if (row == n) ans.pb(board);
    return;
    for (j = 0 to n) {
        if (isSafe(board, row, j, n)) {
            board[row][j] = 'Q';
            nQueens(board, row+1, n);
            board[row][j] = '.';
        }
    }
}
```

isSafe()

① for (j = 0 to n) {  
 if (B[row][j] == 'Q')  
 return false;

② for (i = 0 to n) {  
 if (B[i][col] == 'Q')  
 return false;

③ left Diagonal  
 for (i = 0, j = 0; i >= 0 & j <= n; i--, j++) {  
 if (B[i][j] == 'Q')  
 return false;

④ right Diagonal  
 for (i = 0, j = n; i <= n & j <= 0; i++, j--) {  
 if (B[i][j] == 'Q')  
 return false;