# Homework #6

Surabhi Raghavan

October 15, 2024

## Problem 4

Write an algorithm that takes an integer n as input and determines the total number of solutions to the n-Queens problem.

### Solution

The n-queens problem involves placing n queens on a n x n chessboard such that no two queens threaten each other.
Two queens do not threaten each other if:

- if 2 queens are in the same row
- if 2 queens are in the same column
- if 2 queens are iin the same diagonal

We need two separate functions- one to place the queen in a particular position and another to determine all combinations of the solutions.

Alogrithm: Determine if a queen can be placed at a particular position
Input: k (int)- represents the kth queen
Output: Returns 1 if the queen can be placed and 0 if it cannot

**Algorithm 1** Place$(k, i)$

```
1: for j = 1 to k − 1 do
2:     if x[j] = i or |j − k| = |x[j] − i| then
3:         return 0
4:     end if
5: end for
6: return 1
```

Alogrithm: Function to determine the number of solutions to the n-queens problem
Input: n (int)- represents the number of queens and the size of the chessboard
Output: Number of solutions

**Algorithm 2** NQueens(n)

```
1: k ← 1
2: x[k] ← 0
3: solution_count ← 0                          ▷ Initialize counter for number of solutions
4: while k > 0 do
5:     x[k] ← x[k] + 1
6:     while x[k] ≤ n and not PLACE(k, x[k]) do
7:         x[k] ← x[k] + 1
8:     end while
9:     if x[k] ≤ n then
10:        if k == n then
11:            solution_count ← solution_count + 1          ▷ Increment solution count
12:        else
13:            k ← k + 1
14:            x[k] ← 0
15:        end if
16:    else
17:        k ← k − 1
18:    end if
19: end while
20: return solution_count                      ▷ Return the total number of solutions found
```

# Problem 10

Find at least two instances of the n-Queens problem that have no solutions.

## Solution

# Problem

State the problem here.

## Solution