Title: Implementation of toy problems

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AIM :

To implement the N-queens problem by backtracking.

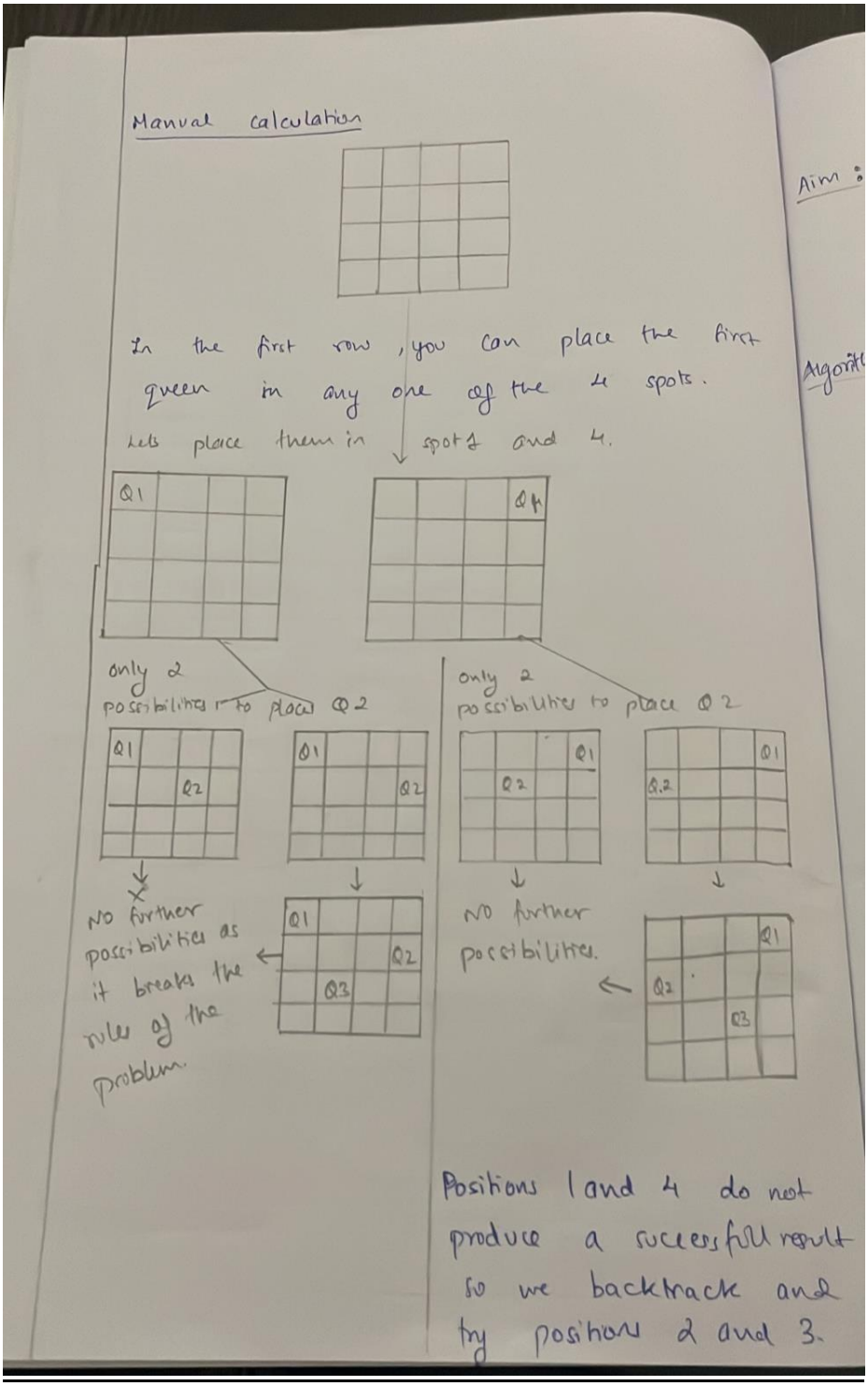
PSEUDO CODE :

```
Place (k, i)
  {
    For j ← 1 to k - 1       do if (x
[j] = i)         or (Abs x [j]) - i) =
(Abs (j - k))
   then return false;
return true;
}
N - Queens (k, n)
{
  For i ← 1 to n
do if Place (k, i) then
  {        x [k] ← i;
if
(k      ==n)   then         write
(x      [1....n));
else
     N - Queens (k + 1, n);
  }
}
```

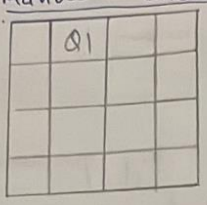
PROGRAM :

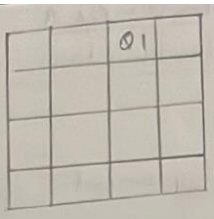
```
# Taking number of queens as input from user
print ("Enter the number of queens")
N = int(input())

# here we create a chessboard
# NxN matrix with all elements set to 0
board = [[0]*N for _ in range(N)]

def attack(i, j):
    #checking vertically and horizontally
    for k in range(0,N):
        if board[i][k]==1 or board[k][j]==1:
            return True
    #checking diagonally
    for k in range(0,N):
        for l in range(0,N):
            if (k+l==i+j) or (k-l==i-j):
                if board[k][l]==1:
                    return True
    return False

def N_queens(n):
    if n==0:
        return True
    for i in range(0,N):
        for j in range(0,N):
            if (not(attack(i,j))) and (board[i][j]!=1):
                board[i][j] = 1
                if N_queens(n-1)==True:
                    return True
                board[i][j] = 0

    return False

N_queens(N)
for i in board:
    print (i)
```

Manual Calculations :

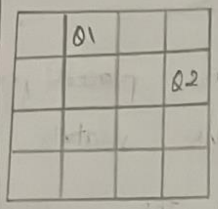


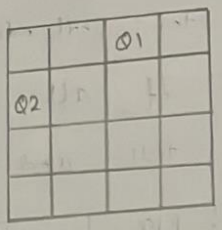
Manual Calculations:



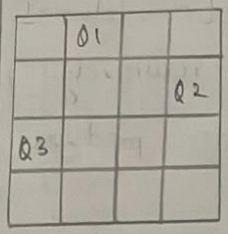


only 1 possibility of placing Q1

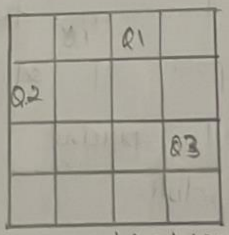




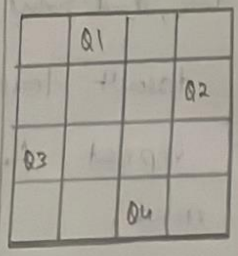
only 1 possibility of placing Q3

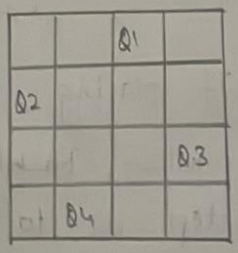


1 solution possible



1 solution possible.





Total solutions : 2

OUTPUT :

```
            if (not(attack(i,j))) and (board[i][j]!=1):
                board[i][j] = 1
                if N_queens(n-1)==True:
                    return True
                board[i][j] = 0
    return False
N_queens(N)
for i in board:
    print (i)
```

```
Enter the number of queens
4
[0, 1, 0, 0]
[0, 0, 0, 1]
[1, 0, 0, 0]
[0, 0, 1, 0]
```

RESULT :

The N-queens problem has been successfully executed.