

Experiment. No. 05

Title : Design n -queens matrix having first queen placed. Use backtracking to place remaining queens to generate the final n -queens matrix

objective : To understand and solve n -queens problem, and understand basics of Backtracking

Theory :

Introduction to Backtracking :

many problems are difficult to solve algorithmically. Backtracking makes it possible to solve at least some large instances of difficult combinatorial problems.

we don't have enough information to know what to choose.

each decision leads to a new set of choices

Some sequence of choice may be a solution to your problem.

what is Backtracking :

Backtracking is finding the solution of a problem whereby the solution depends on the previous steps taken.

In backtracking, we first take a step and then we see if this step taken is correct or not i.e.

whether it will give a correct answer or
And if it doesn't, then we just come back
and change our first step.

thus, in backtracking, we first start
partial sub-solution of the problem and
check if we can proceed further with the
sub-solution or not.

thus, the general steps of backtracking

- start with a sub-solution
- check if this sub-solution will lead to the solution or not.
- if not, then come back & change the sub-solution and continue again

N-Queens Problems:

A classical combinatorial problem is to place n queens on a $n \times n$ chess board so that no two queens share the same row, column or diagonal.

N queen problem is the classical example of backtracking.

For $N=1$, this is a trivial case, for $N=2$ and $N=3$, a solution is not possible, we just start with $N=4$ and generate it for N queens.

If we take $n=4$ then the problem is the 4 queens problem.

If we take $n=8$ then the problem is the 8 queens problem.

Algorithm :

1. start in the leftmost column
2. If all queens are placed return true
3. Try all columns rows in the current column.

Do following for every tried row

a) If the queen can be placed safely in the row then mark this [row, column] as part of the solution and recursively checking if placing queen here leads to a solution.

b) If placing the queen in [row, column] leads to a solution then return true

c) If placing queen doesn't lead to a solution then unmark this [row, column] and go to step (a) to try other rows.

4. If all rows have been tried and nothing worked, return false to trigger backtracking.

Conclusion:

In this way we have studied & implemented concept of Backtracking method and solve n-queen problem using backtracking method.