Design & Analysis of Algorithms

Monsoon Semester III 2020-21

**Lab - 4** Date: **28 September 2020**

**Topics: Backtracking**

**AIM**

To explore back tracking algorithm to solve the problems.

**THEORY**

Backtracking is an algorithmic-technique for solving problems recursively by trying to build a solution incrementally, one piece at a time, removing those solutions that fail to satisfy the constraints of the problem at any point of time

# EXPERIMENT

1. A backtracking algorithm for solving N Queen problem was implemented. All possible solution for N Queen and also the number of backtracks was computed. The experiment was performed from N = 2 to 9.

PSEUDOCODE:

* Start in the leftmost column
* If all queens are placed, return true
* for (every possible choice among the rows in this column)
* if the queen can be placed safely there,
  + make that choice and then recursively try to place the rest of the queens
  + if recursion successful, return true
  + if !successful, remove queen and try another row in this column
* if all rows have been tried and nothing worked, return false to trigger backtracking

1. A Suduko problem using backtracking approach was solved and the number of backtracks was counted.

It’s a puzzle printed on a square grid of size 9x9, the object of which is to fill the 81 squares so that each row, column and the large square contains every number from 1 – 9

PSEUDOCODE:

* Find row, col of an unassigned cell
* If there is none, return true
* For digits from 1 to 9
* a) If there is no conflict for digit at row, col
* assign digit to row, col and recursively try fill in rest of grid
* b) If recursion successful, return true
* c) Else, remove digit and try another
* If all digits have been tried and nothing worked,
* return false

3. A **set** of candidate numbers (candidates) **(without duplicates)** and a target number (target) was given. All unique combinations in candidates where the candidate numbers sums to target was found.

Observation:

For N-Queen problem,

|  |  |  |
| --- | --- | --- |
| Dimension of Chess Board | Backtracks Observed | Number of solutions |
| 2 X 2 | - | - |
| 3 X 3 | - | - |
| 4 X 4 | 16 | 10 |
| 5 X 5 | 53 | 4 |
| 6 X 6 | 152 | 6 |
| 7 X 7 | 551 | 40 |
| 8 X 8 | 2056 | 92 |
| 9 X 9 | 8393 | 352 |

Conclusion:

Understood the implementation and uses of Backtracking.