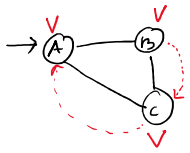
U

08 April 2025 21:59



DFS:-

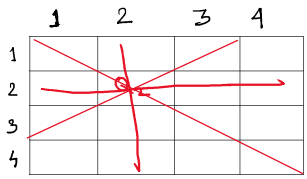
A C B

The **4-Queens Problem** is a well-known puzzle that involves placing 4 queens on an 4×4 chessboard in such a way that no two queens threaten each other.

How to Solve the 4 Queen Problem?

To solve this problem, we will use a backtracking algorithm. Backtracking is a technique where we explore all possible solutions by incrementally building the solution and backtracking whenever we find that the current solution is invalid.

Each queen should be in different Row, different column and different diagonal.

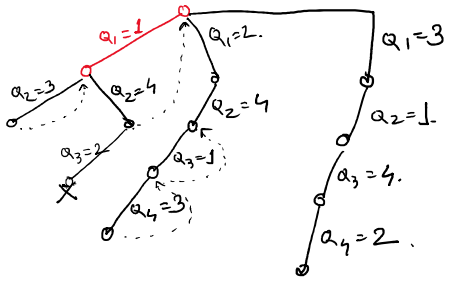


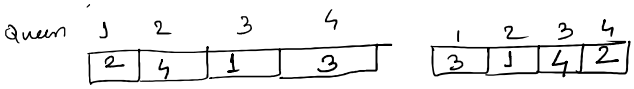
Q_1 = Row 1

Q_2 = Row 2

Q_3 = Row 3

Q_4 = Row 4.





📝 N-Queen Problem (4x4) – Theory Using Backtracking

The **N-Queen problem** is a classic **backtracking** problem where the goal is to place **N queens** on an **N×N chessboard** such that **no two queens** threaten each other. This means:

- No two queens can be in the **same row**, **same column**, or **same diagonal**.

In the **4x4 N-Queen problem**, we have to place **4 queens** on a **4×4 board** without any queen attacking another.

🔹 Backtracking Approach

Backtracking is a **trial-and-error** method that incrementally builds solutions and **backtracks** when a conflict is detected.

Steps:

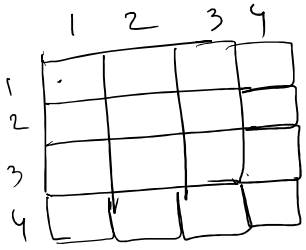
1. **Start from column 0**, try placing a queen in each row one by one.
2. For each attempted position, check if it is **safe**:
   - No other queen in the same **row** to the left.
   - No other queen in the **upper left diagonal**.
   - No other queen in the **lower left diagonal**.
3. If safe, **place the queen** and recursively attempt to place the next queen in the next column.
4. If placing a queen leads to no solution, **backtrack**: remove the queen and try the next position.
5. Repeat until all **4 queens** are placed successfully.

🔹 Base Case

If all 4 queens are placed (i.e., column index = 4), then a valid solution is found.

🔹 Time Complexity

The worst-case time complexity is **O(N!)**, as we may need to try all permutations.



$Q_1 = 4$

$Q_2 = 3$

$Q_3 = 2$

$Q_4 = 1$

$4 \times 3 \times 2 \times 1$

$= 4!$