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EXPERIMENT- 6

Aim:

Write a program to implement N-Queen Problem using backtracking and analyze its time complexity.

Code:

```
#include <iostream>
#include <vector>
#include <ctime>

using namespace std;

bool isSafe(int row, int col, const vector<int>& placement) {
    for (int i = 0; i < row; ++i) {
        if (placement[i] == col || abs(i - row) == abs(placement[i] - col)) {
            return false;
        }
    }
    return true;
}

void printBoard(const vector<int>& placement) {
    int N = placement.size();
    for (int i = 0; i < N; ++i) {
        for (int j = 0; j < N; ++j) {
            if (placement[i] == j) {
                cout << "Q" << "\t";
            } else {
                cout << "." << "\t";
            }
        }
        cout << endl;
    }
    cout << endl;
}

bool solveNQueens(int row, int N, vector<int>& placement) {
    if (row == N) {
        printBoard(placement);
        return true;
    }

    for (int col = 0; col < N; ++col) {
        if (isSafe(row, col, placement)) {
            placement[row] = col;
            if (solveNQueens(row + 1, N, placement)) {
                return true; // Stop after finding the first solution
            }
```

```
        }
    }

    return false;
}

int main() {
    int N;
    cout << "Enter the size of the chessboard (N): ";
    cin >> N;

    vector<int> placement(N, -1); // Initializing with -1, indicating no queen placed yet

    clock_t start = clock();

    if (!solveNQueens(0, N, placement)) {
        cout << "No solution found." << endl;
    }

    clock_t end = clock();
    double executionTime = double(end - start) * 1000.0/ CLOCKS_PER_SEC;

    cout << "Execution time: " << executionTime << " milliseconds" << endl;

    return 0;
}
```

Output:

```
Enter the size of the chessboard (N): 8
Q   .   .   .   .   .   .   .
.   .   .   .   Q   .   .   .
.   .   .   .   .   .   .   Q
.   .   .   .   .   Q   .   .
.   .   Q   .   .   .   .   .
.   .   .   .   .   .   Q   .
.   Q   .   .   .   .   .   .
.   .   .   Q   .   .   .   .

Execution time: 0.136 milliseconds
```