U18C0018
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AIML
Assignment-4

Implement N queens problem using below algorithms in prolog.
Compare the complexity of both algorithms.

1-> Depth First Search

DFS.py

```
from queue import Queue
N=5
class NQueens:
    def __init__(self, size):
        self.size = size
    def solve_dfs(self):
        if self.size < 1:
            return []
        solutions = []
        stack = [[]]
        while stack:
            solution = stack.pop()
            if self.conflict(solution):
                continue
            row = len(solution)
            if row == self.size:
                solutions.append(solution)
                continue
            for col in range(self.size):
                queen = (row, col)
                queens = solution.copy()
                queens.append(queen)
                stack.append(queens)
        return solutions
    def conflict(self, queens):
        for i in range(1, len(queens)):
            for j in range(0, i):
                a, b = queens[i]
                c, d = queens[j]
                if a == c or b == d or abs(a - c) == abs(b - d):
```

```
                    return True
        return False
    def print(self, queens):
        for i in range(self.size):
            for j in range(self.size):
                p = 'Q' if (i, j) in queens else '-'
                print('%s ' % p, end='')
            print()
def main():
    n_queens = NQueens(N)
    dfs_solutions = n_queens.solve_dfs()
    for i, solution in enumerate(dfs_solutions):
        print('DFS Solution %d:' % (i + 1))
        n_queens.print(solution)
if __name__ == '__main__':
    main()
```

Ouptput:-

```
MINGW64:/d/xampp/htdocs/Assignments/AIML
shubham@DESKTOP-RB7GMLA MINGW64 /d/xampp/htdocs/Assignments/AIML
$ python DFS.py
DFS Solution 1:
- - - - Q
- - Q - -
Q - - - -
- - - Q -
- Q - - -
DFS Solution 2:
- - - - Q
- Q - - -
- - - Q -
Q - - - -
- - Q - -
DFS Solution 3:
- - - Q -
- Q - - -
- - - - Q
- - Q - -
Q - - - -
DFS Solution 4:
- - - Q -
Q - - - -
- - Q - -
- - - - Q
- Q - - -
DFS Solution 5:
- - Q - -
- - - - Q
- Q - - -
- - - Q -
Q - - - -
DFS Solution 6:
- - Q - -
Q - - - -
- - - Q -
- Q - - -
- - - - Q
DFS Solution 7:
- Q - - -
- - - - Q
- - Q - -
Q - - - -
- - - Q -
DFS Solution 8:
- Q - - -
- - - Q -
Q - - - -
- - Q - -
- - - - Q
DFS Solution 9:
Q - - - -
- - - Q -
- Q - - -
- - - - Q
- - Q - -
DFS Solution 10:
Q - - - -
```

2-> Breadth First Search

BFS.py

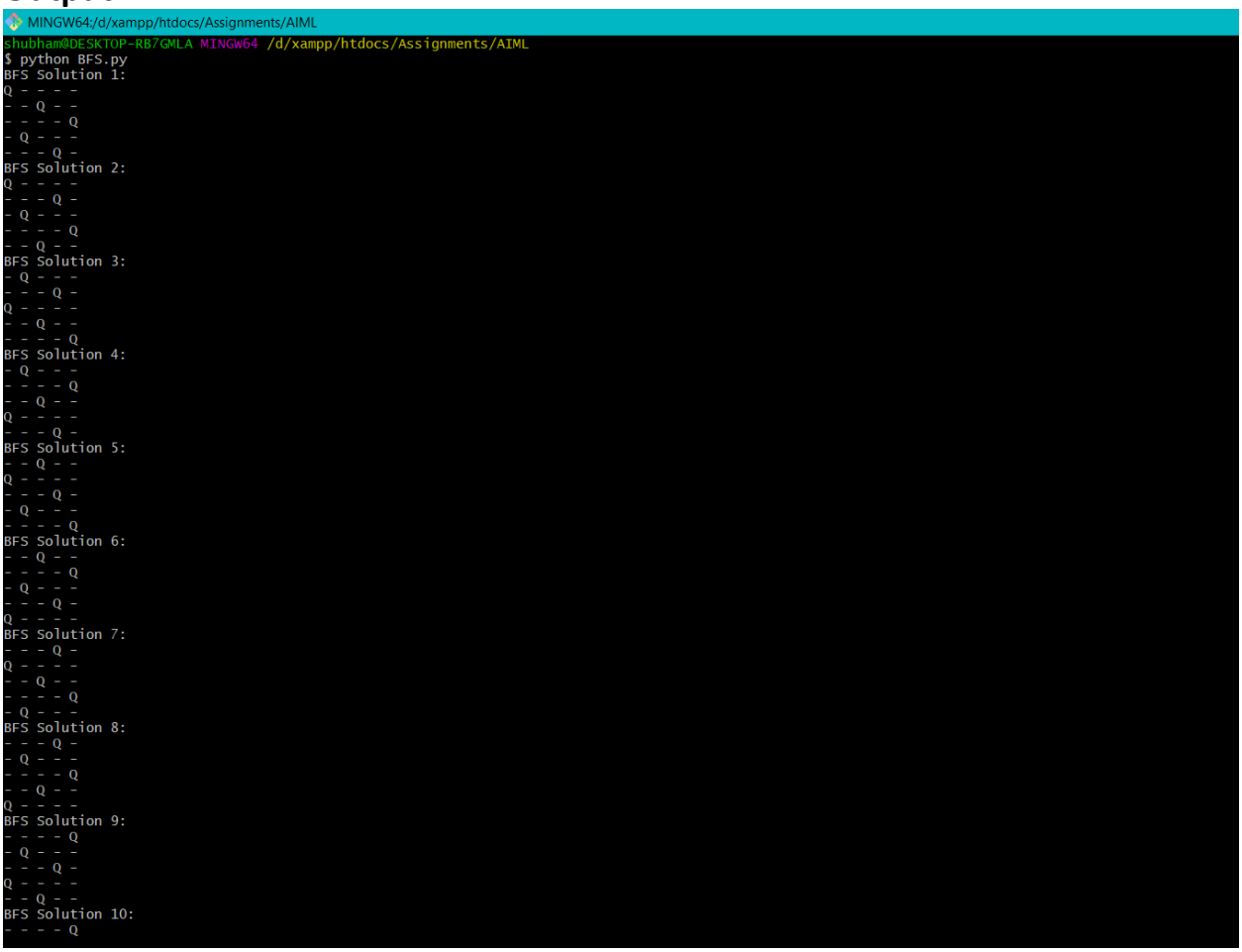
```
from queue import Queue
N=5
class NQueens:
    def __init__(self, size):
        self.size = size
    def solve_bfs(self):
        if self.size < 1:
            return []
        solutions = []
        queue = Queue()
        queue.put([])
        while not queue.empty():
            solution = queue.get()
            if self.conflict(solution):
                continue
            row = len(solution)
            if row == self.size:
                solutions.append(solution)
                continue
            for col in range(self.size):
                queen = (row, col)
                queens = solution.copy()
                queens.append(queen)
                queue.put(queens)
        return solutions
    def conflict(self, queens):
        for i in range(1, len(queens)):
            for j in range(0, i):
                a, b = queens[i]
                c, d = queens[j]
                if a == c or b == d or abs(a - c) == abs(b - d):
                    return True
        return False
    def print(self, queens):
        for i in range(self.size):
            for j in range(self.size):
                p = 'Q' if (i, j) in queens else '-'
                print('%s ' % p, end='')
            print()

def main():
```

```
    n_queens = NQueens(N)
    bfs_solutions = n_queens.solve_bfs()
    for i, solution in enumerate(bfs_solutions):
        print('BFS Solution %d:' % (i + 1))
        n_queens.print(solution)

if __name__ == '__main__':
    main()
```

Output:-



3-> Which algorithm is best suited for implementing N queens' problem and why ?

Comparison Between both the approach

- The DFS algorithm is quicker than BFS algorithm
- Number of extended node in DFS algorithm is less than BFS
- the required memory for BFS is larger than DFS. Using this method, time and cost of solving n-queens problem is minimized in comparison of old methods.