ASSIGNMENT NO. 3

1 TITLE :

8 Queen matrix is stored using JSON/Xml having first queen placed, Used Backtracking to placed remaining queens to generate final 8 Queen matrix using Python.

2 OBJECTIVE :

To study 8 Queens problem, and implement it using Python

3 THEORY :

The 8 queen problem is a case of more general set of problems namely n queen problem. The basic idea: How to place n queen on n by n board, so that they dont attack each other.

As we can expect the complexity of solving the problem increases with n. We will briefly introduce solution by backtracking. First lets explain what is backtracking? The boar should be regarded as a set of constraints and the solution is simply satisfying all constraints.

For example: Q1 attacks some positions, therefore Q2 has to comply with these constraints and take place, not directly attacked by Q1. Placing Q3 is harder, since we have to satisfy constraints of Q1 and Q2.

Going the same way we may reach point, where the constraints make the placement of the next queen impossible. Therefore we need to relax the constraints and find new solution. To do this we are going backwards and finding new admissible solution. To keep everything in order we keep the simple rule: last placed, first displaced.

In other words if we place successfully queen on the ith column but cannot find solution for$(i+1)th$ queen, then going backwards we will try to find other admissible solution for the ith queen first. This process is called backtrack .

3.1 MATHEMATICAL MODEL :

Input : Size of Board and Initial state of queen.
Output : 8 queen placed in 8*8 matrix in such a way that they do not attack each other.
Formula:

int PlaceQueen(int board[8], int row)
If (Can place queen on ith column)
PlaceQueen(newboard, 0)
Else
PlaceQueen(oldboard,oldplace+1)
End

3.2 ELIMINATION OF REDUNDANT CONTROL STATEMENTS :

We have managed to eliminate redundant control statements since we are using python.

4 TESTING :

4.1 BLACK BOX TESTING :

Black-box testing is a method of software testing that examines the
function- ability of an application without peering into its internal structures or workings.
This method of test can be applied to virtually every level of
software testing:unit, integration, system and acceptance
Typical Input Data: Position of first queen
Expected Output: Possible positions of remaining 7 queens to satisfy the 8 Queen Problem

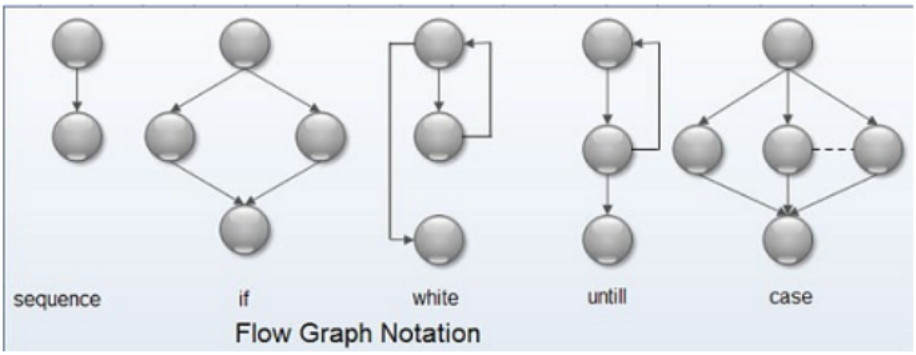
Example:
Input:

$$X = 4, Y = 4$$

Output:
[2, 0, 6, 4, 7, 1, 3, 5]
[2, 5, 1, 4, 7, 0, 6, 3]
[3, 1, 6, 4, 0, 7, 5, 2]
[3, 1, 7, 4, 6, 0, 2, 5]
[3, 5, 0, 4, 1, 7, 2, 6]
[3, 7, 0, 4, 6, 1, 5, 2]
[5, 3, 0, 4, 7, 1, 6, 2]
[6, 3, 1, 4, 7, 0, 2, 5]
8

4.2 WHITE BOX TESTING :

White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) is a method of testing software that tests internal structures or workings of an application, as opposed to its functionality(i.e. black-box testing). While developing test cases for white box testing it is understood that complete testing is impossible. In White Box testing we checkup to which extent the code is being executed, i.e. Covered. There are different kinds of coverage like, statement coverage, path coverage, etc. We will use one of the most popular technique i.e. Statement coverage. Statement coverage is a white box testing technique, which involves the execution of all the statements at least once in the source code. It is a metric, which is used to calculate and measure the number of statements in the source code which have been executed. For this, we will use Flow Graphs. Flow graphs are, Syntactic abstraction of source code Resembling to classical flow charts Forms the basis for white box test case generation principles.Conventions of flow graph notation,
Sample Input: For integer array int A[] = 1,2,3,4,5,6,7,8,9,10; Function is passed
following arguments: Binary Search(A, 1, 10, 7);
Output obtained: Entered second Entered third Entered first 6
The underlined nodes are the ones being tested. The above output shows that every test region is covered for given input.



aasign(8 queens)/pqr.png

Sample Input:
Given coordinates (X,Y) = 4,4
Output obtained:

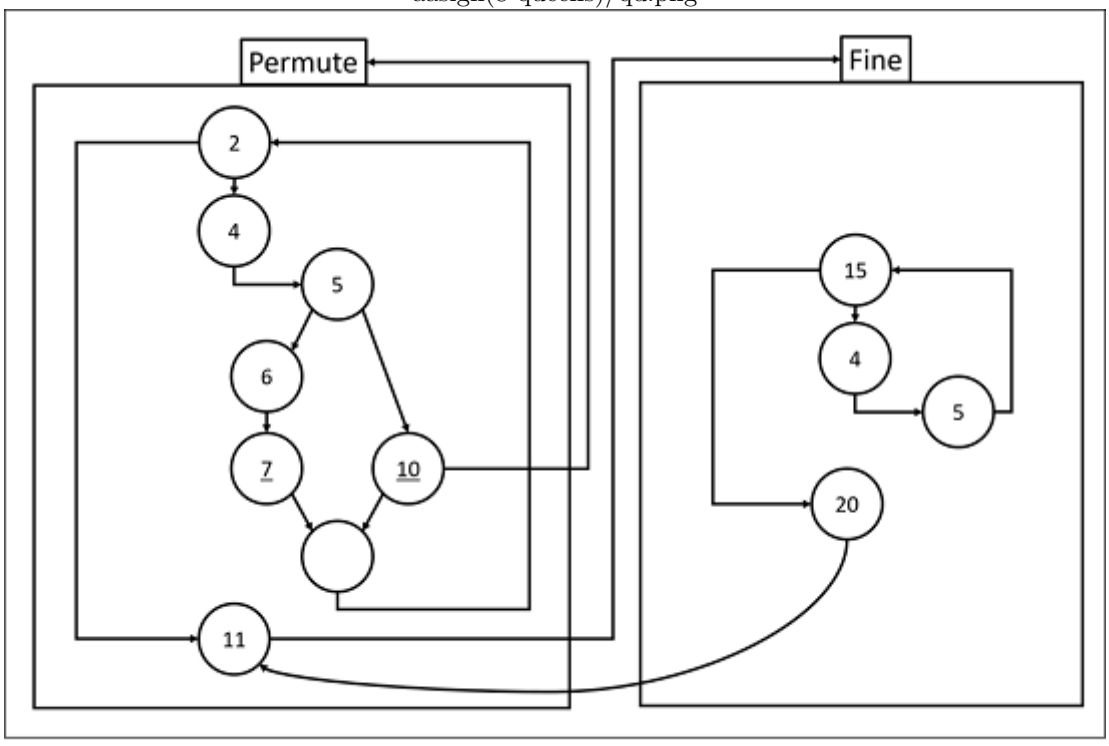
$ValidCase$: [0, 4, 7, 5, 2, 6, 1, 3]
$ValidCase$: [0, 5, 7, 2, 6, 3, 1, 4]
$ValidCase$: [0, 6, 3, 5, 7, 1, 4, 2]
$ValidCase$: [0, 6, 4, 7, 1, 3, 5, 2]
$ValidCase$: [1, 3, 5, 7, 2, 0, 6, 4]
$ValidCase$: [1, 4, 6, 0, 2, 7, 5, 3]
$ValidCase$: [1, 4, 6, 3, 0, 7, 5, 2]
$ValidCase$: [1, 5, 0, 6, 3, 7, 2, 4]

aasign(8 queens)/quee.png

```
1  def Permute(queens, row):
2      for i in range(8):
3          queens[row] = i
4          if Fine(queens, row):
5              if row == 7:
6                  if queens[x-1] == y:
7                      print(queens)
8                      globals()["solutions"] = globals()["solutions"] + 1
9              else:
10                 Permute(queens, row+1)
11
12 def Fine(queens, row):
13     c = 0
14     derga = True
15     for i in range(row):
16         c, cur, oth = c+1, queens[row], queens[row-i-1]
17         if (cur == oth) or (cur-c == oth) or (cur+c == oth):
18             derga = False
19             break
20     return(derga)
21
```

Function

aasign(8 queens)/qu.png



Flow Graph Notation

$ValidCase$: $[1, 5, 7, 2, 0, 3, 6, 4]$
$ValidCase$: $[1, 6, 2, 5, 7, 4, 0, 3]$
$ValidCase$: $[1, 6, 4, 7, 0, 3, 5, 2]$
$ValidCase$: $[1, 7, 5, 0, 2, 4, 6, 3]$
$SolutionCase$: $[2, 0, 6, 4, 7, 1, 3, 5]$
$ValidCase$: $[2, 0, 6, 4, 7, 1, 3, 5]$
$ValidCase$: $[2, 4, 1, 7, 0, 6, 3, 5]$
$ValidCase$: $[2, 4, 1, 7, 5, 3, 6, 0]$
$ValidCase$: $[2, 4, 6, 0, 3, 1, 7, 5]$

$ValidCase$: $[2, 4, 7, 3, 0, 6, 1, 5]$
$SolutionCase$: $[2, 5, 1, 4, 7, 0, 6, 3]$
$ValidCase$: $[2, 5, 1, 4, 7, 0, 6, 3]$
$ValidCase$: $[2, 5, 1, 6, 0, 3, 7, 4]$
$ValidCase$: $[2, 5, 1, 6, 4, 0, 7, 3]$
$ValidCase$: $[2, 5, 3, 0, 7, 4, 6, 1]$
$ValidCase$: $[2, 5, 3, 1, 7, 4, 6, 0]$
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$ValidCase$: $[2, 6, 1, 7, 4, 0, 3, 5]$
$ValidCase$: $[2, 6, 1, 7, 5, 3, 0, 4]$
$ValidCase$: $[2, 7, 3, 6, 0, 5, 1, 4]$
$ValidCase$: $[3, 0, 4, 7, 1, 6, 2, 5]$
$ValidCase$: $[3, 0, 4, 7, 5, 2, 6, 1]$
$ValidCase$: $[3, 1, 4, 7, 5, 0, 2, 6]$
$ValidCase$: $[3, 1, 6, 2, 5, 7, 0, 4]$
$ValidCase$: $[3, 1, 6, 2, 5, 7, 4, 0]$
$SolutionCase$: $[3, 1, 6, 4, 0, 7, 5, 2]$
$ValidCase$: $[3, 1, 6, 4, 0, 7, 5, 2]$
$SolutionCase$: $[3, 1, 7, 4, 6, 0, 2, 5]$
$ValidCase$: $[3, 1, 7, 4, 6, 0, 2, 5]$
$ValidCase$: $[3, 1, 7, 5, 0, 2, 4, 6]$
$SolutionCase$: $[3, 5, 0, 4, 1, 7, 2, 6]$
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$ValidCase$: $[3, 5, 7, 1, 6, 0, 2, 4]$
$ValidCase$: $[3, 5, 7, 2, 0, 6, 4, 1]$
$ValidCase$: $[3, 6, 0, 7, 4, 1, 5, 2]$
$ValidCase$: $[3, 6, 2, 7, 1, 4, 0, 5]$
$ValidCase$: $[3, 6, 4, 1, 5, 0, 2, 7]$
$ValidCase$: $[3, 6, 4, 2, 0, 5, 7, 1]$
$ValidCase$: $[3, 7, 0, 2, 5, 1, 6, 4]$
$SolutionCase$: $[3, 7, 0, 4, 6, 1, 5, 2]$
$ValidCase$: $[3, 7, 0, 4, 6, 1, 5, 2]$
$ValidCase$: $[3, 7, 4, 2, 0, 6, 1, 5]$
$ValidCase$: $[4, 0, 3, 5, 7, 1, 6, 2]$
$ValidCase$: $[4, 0, 7, 3, 1, 6, 2, 5]$
$ValidCase$: $[4, 0, 7, 5, 2, 6, 1, 3]$
$ValidCase$: $[4, 1, 3, 5, 7, 2, 0, 6]$
$ValidCase$: $[4, 1, 3, 6, 2, 7, 5, 0]$
$ValidCase$: $[4, 1, 5, 0, 6, 3, 7, 2]$
$ValidCase$: $[4, 1, 7, 0, 3, 6, 2, 5]$
$ValidCase$: $[4, 2, 0, 5, 7, 1, 3, 6]$
$ValidCase$: $[4, 2, 0, 6, 1, 7, 5, 3]$
$ValidCase$: $[4, 2, 7, 3, 6, 0, 5, 1]$
$ValidCase$: $[4, 6, 0, 2, 7, 5, 3, 1]$
$ValidCase$: $[4, 6, 0, 3, 1, 7, 5, 2]$
$ValidCase$: $[4, 6, 1, 3, 7, 0, 2, 5]$
$ValidCase$: $[4, 6, 1, 5, 2, 0, 3, 7]$
$ValidCase$: $[4, 6, 1, 5, 2, 0, 7, 3]$
$ValidCase$: $[4, 6, 3, 0, 2, 7, 5, 1]$
$ValidCase$: $[4, 7, 3, 0, 2, 5, 1, 6]$
$ValidCase$: $[4, 7, 3, 0, 6, 1, 5, 2]$
$ValidCase$: $[5, 0, 4, 1, 7, 2, 6, 3]$
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$ValidCase$: $[5, 2, 0, 6, 4, 7, 1, 3]$
$ValidCase$: $[5, 2, 0, 7, 3, 1, 6, 4]$
$ValidCase$: $[5, 2, 0, 7, 4, 1, 3, 6]$
$ValidCase$: $[5, 2, 4, 6, 0, 3, 1, 7]$
$ValidCase$: $[5, 2, 4, 7, 0, 3, 1, 6]$

$ValidCase$: [5, 2, 6, 1, 3, 7, 0, 4]
$ValidCase$: [5, 2, 6, 1, 7, 4, 0, 3]
$ValidCase$: [5, 2, 6, 3, 0, 7, 1, 4]
$SolutionCase$: [5, 3, 0, 4, 7, 1, 6, 2]
$ValidCase$: [5, 3, 0, 4, 7, 1, 6, 2]
$ValidCase$: [5, 3, 1, 7, 4, 6, 0, 2]
$ValidCase$: [5, 3, 6, 0, 2, 4, 1, 7]
$ValidCase$: [5, 3, 6, 0, 7, 1, 4, 2]
$ValidCase$: [5, 7, 1, 3, 0, 6, 4, 2]
$ValidCase$: [6, 0, 2, 7, 5, 3, 1, 4]
$ValidCase$: [6, 1, 3, 0, 7, 4, 2, 5]
$ValidCase$: [6, 1, 5, 2, 0, 3, 7, 4]
$ValidCase$: [6, 2, 0, 5, 7, 4, 1, 3]
$ValidCase$: [6, 2, 7, 1, 4, 0, 5, 3]
$SolutionCase$: [6, 3, 1, 4, 7, 0, 2, 5]
$ValidCase$: [6, 3, 1, 4, 7, 0, 2, 5]
$ValidCase$: [6, 3, 1, 7, 5, 0, 2, 4]
$ValidCase$: [6, 4, 2, 0, 5, 7, 1, 3]
$ValidCase$: [7, 1, 3, 0, 6, 4, 2, 5]
$ValidCase$: [7, 1, 4, 2, 0, 6, 3, 5]
$ValidCase$: [7, 2, 0, 5, 1, 4, 6, 3]
$ValidCase$: [7, 3, 0, 2, 5, 1, 6, 4]
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4.3 POSITIVE/NEGATIVE TESTING

Positive Testing :
If proper position is entered then all solutions are found.
Negative Testing :
if uknown position is entered the program must fail to produce outputs

4.4 ADVANCED TESTING TECHNIQUE

Google Testing Framework can be used in future for testing the code

5 Pseudocode:

(Integer boardSize, Queen queen[boardSize]);
i ¡- 0 //Begin by placing the queen number 0
while i ¡ boardSize
queen[i].row ¡- queen[i].row + 1 //Place queen[i] to next row
/* If queen[i] exceeds the row count, reset the queen and
re-place queen[i-1]
/*
if(queen[i].row ¿= boardSize)
queen[i] ¡- -1;
i ¡- i - 1;
else
//While the queen[i] is under attack move it down the row
while(isUnderAttack(queen[i])
queen[i].row ¡- queen[i] + 1;
//if queen[i] exceeds the row count, reset it, re-place queen[i-1]
if(queen[i].row ¿= boardSize)
queen[i].row ¡- -1
i ¡- i - 1;
else
i++;
end while

6 CONCLUSION :

We have studied 8 - Queens problem and have successfully implemented it in python.

Roll No.	Name of Student	Date of Performance	Date of Submission	Sign.
BECOC357	Sunny Shah	13 / 07 / 2017	27 / 07 / 2017	

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7 PLAGIARISM REPORT :

aasign(8 queens)/8Queen$_P$lag.png

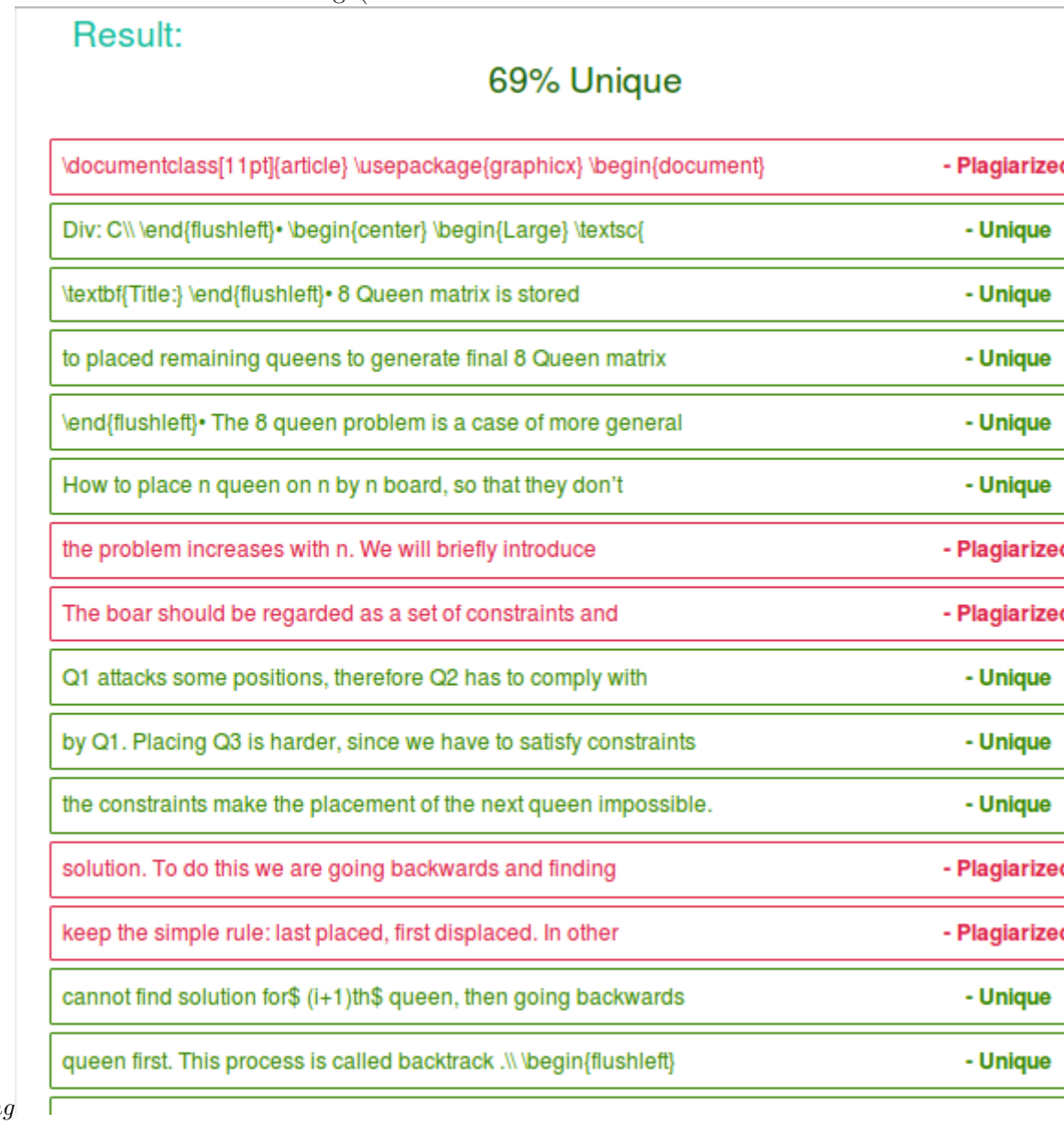

Figure 1: Plagarism Checker: www.smallseotools.com/plagarism-checker