Analysis and Design of Algorithms

Semester III, Year **2021-22**

Lab - 5 Date : 01-11-2021

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AIM:

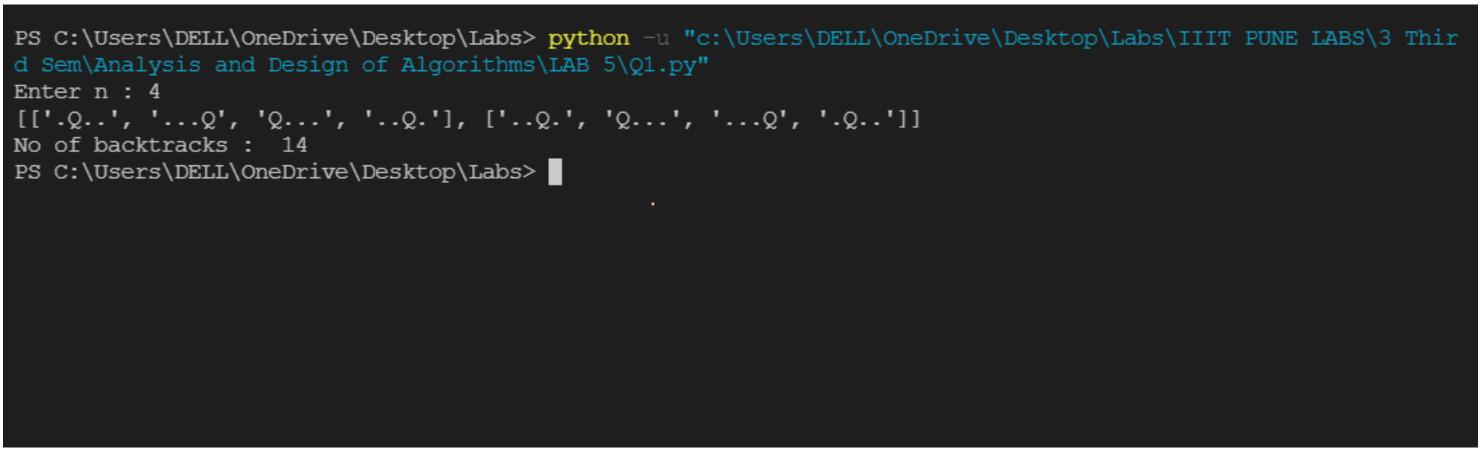
1. Implement a backtracking algorithm for solving N Queen problem. Compute all possible solution for N Queen and also compute the number of backtracks. Perform the experiment from N = 2 to 9.

2. Given a set of candidate numbers (candidates) (without duplicates) and a target number (target), find all unique combinations in candidates where the candidate numbers sums to target. eg. W : [5, 10, 12, 13, 15, 18] and target = 30.

Question 1:
Pseudo Code:

```
START

inSafe(sol,row,col,n) // checks if the position has any Queens in the same column, and the same diagonals
 For i = 0 to col
    If sol[row][i] == ‘Q’ //checking if the column has a Queen
         Return False
For i = row to 0 and j = col to 0
    If sol[i][j] == ‘Q’ //checking if one of the diagonal has a Queen
         i = i-1, j = j-1
         Return False
For i = row to n and j = col to 0
    If sol[i][j] == ‘Q’ //checking if the other diagonal has a Queen
         i = i+1, j = j-1
         Return False

Return True // If the position is safe we return true

QInsert(sol,col,n) // We insert the queens in the rows, one in each column
If col == n // All the queens are placed add it to the solution list and return true
    Solx = []
    For i in sol
         For j = 0 to len(i)
              If i[j] == ‘Q’
                   solx.append(j+1)
              j = j+1
         i = i+1
    Posns.append(solx) //adding all the solutions to the final solution list
    Return true
q = false
For i = 0 to n // In that column we keep insertion Queen in each row and check
    If inSafe(sol,i,col,n)
         Sol[i][col] = ‘Q’
              q = QInsert(sol, col+1,n) or q
              Sol[i][col] = ‘0’ //if the insertion of the queen doesn't give us a solution we backtrack and remove Queen from that position
              bt = bt + 1 // backtracking counter
    Return res

solve(n)
posns.clear() // we clear it so that when we go for next n value we have a clear solutions list
sol = empty board(all positions ‘0’)
QInsert(sol, 0 ,n) // starting from the first column
Return posns //final list of all the solution lists

END
```

Output:

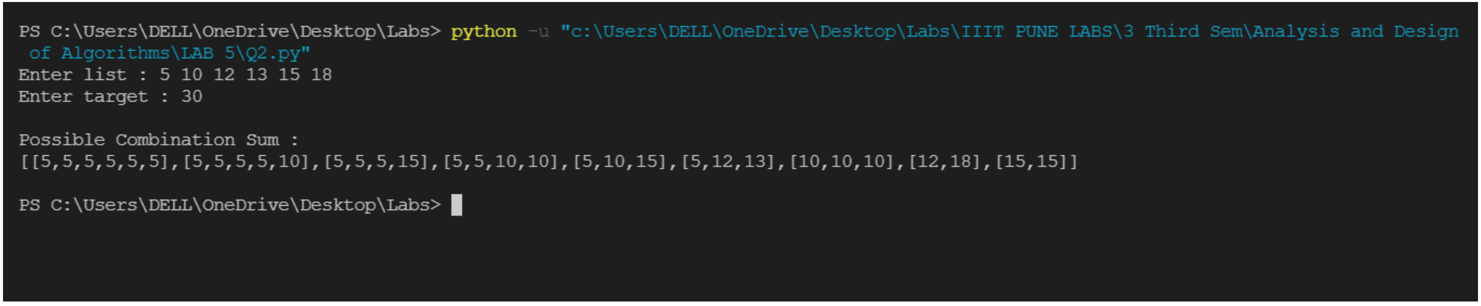


```
PS C:\Users\DELL\OneDrive\Desktop\Labs> python -u "c:\Users\DELL\OneDrive\Desktop\Labs\IIIT PUNE LABS\3 Third Sem\Analysis and Design of Algorithms\LAB 5\Q1.py"
Enter n : 4
[['.Q..', '...Q', 'Q...', '..Q.'], ['..Q.', 'Q...', '...Q', '.Q..']]
No of backtracks :  14
PS C:\Users\DELL\OneDrive\Desktop\Labs> 
```

Question 2:
Pseudo Code:

```
START

FUNCTION combinationSum(List, target):
    result = [ ]          # empty list to store output of code
    tempList = [ ]
    List = sorted(list(set(list))            # sort the list
    Call the function findNumbers(result, List, tempList, target, 0)
    RETURN result
END FUNCTION

FUNCTION findNumbers(result, List, tempList, target, index):
    IF target == 0:
        Append tempList to result          # result.append(list(tempList))
        RETURN
    ENDIF

    FOR i = index till i = len(tempList):
        IF target - List[i] >= 0:
            Append List[i] to tempList                                   # tempList.append(List[i])
            Call function findNumbers(result, List, tempList, target – List[i], i)
            Remove List[i] from tempList                                 # tempList.remove(List[i])
    END FOR
END FUNCTION

List =  input List
Target = Input target
Call the function combinationSum(List, target)

END
```

Output:



```
PS C:\Users\DELL\OneDrive\Desktop\Labs> python -u "c:\Users\DELL\OneDrive\Desktop\Labs\IIIT PUNE LABS\3 Third Sem\Analysis and Design of Algorithms\LAB 5\Q2.py"
Enter list : 5 10 12 13 15 18
Enter target : 30

Possible Combination Sum :
[[5,5,5,5,5,5],[5,5,5,5,10],[5,5,5,15],[5,5,10,10],[5,10,15],[5,12,13],[10,10,10],[12,18],[15,15]]

PS C:\Users\DELL\OneDrive\Desktop\Labs> 
```