Lab test one

1.REMOVE ALL OCCERENCES: **Given an integer array nums and an integer val, remove all occurrences of val in nums** [**in-place**](https://en.wikipedia.org/wiki/In-place_algorithm)**. The relative order of the elements may be changed.**

**Program:**

def remove\_element(nums, val):

i = 0

for j in range(len(nums)):

if nums[j] != val:

nums[i] = nums[j]

i += 1

return i

nums = [3, 2, 2, 3]

val = 3

new\_length = remove\_element(nums, val)

print("New length:", new\_length)

print("Modified array:", nums[:new\_length])

time complexity of 𝑂(𝑛)*O*(*n*)

2. **Determine if a 9 x 9 Sudoku board is valid. Only the filled cells need to be validated according to the following rules:**

1. **Each row must contain the digits 1-9 without repetition.**
2. **Each column must contain the digits 1-9 without repetition.**
3. **Each of the nine 3 x 3 sub-boxes of the grid must contain the digits 1-9 without repetition.**

Program:

def is\_valid\_sudoku(board):

def has\_duplicates(values):

seen = set()

for value in values:

if value != '.':

if value in seen:

return True

seen.add(value)

return False

for row in board:

if has\_duplicates(row):

return False

for col in zip(\*board):

if has\_duplicates(col):

return False

for box\_row in range(0, 9, 3):

for box\_col in range(0, 9, 3):

box = [board[r][c] for r in range(box\_row, box\_row + 3) for c in range(box\_col, box\_col + 3)]

if has\_duplicates(box):

return False

return True

sudoku\_board = [

["5", "3", ".", ".", "7", ".", ".", ".", "."],

["6", ".", ".", "1", "9", "5", ".", ".", "."],

[".", "9", "8", ".", ".", ".", ".", "6", "."],

["8", ".", ".", ".", "6", ".", ".", ".", "3"],

["4", ".", ".", "8", ".", "3", ".", ".", "1"],

["7", ".", ".", ".", "2", ".", ".", ".", "6"],

[".", "6", ".", ".", ".", ".", "2", "8", "."],

[".", ".", ".", "4", "1", "9", ".", ".", "5"],

[".", ".", ".", ".", "8", ".", ".", "7", "9"]

]

print(is\_valid\_sudoku(sudoku\_board))

time complexity of this solution is 𝑂(1)

3. . Sudoku Solver

**Write a program to solve a Sudoku puzzle by filling the empty cells.**

**A sudoku solution must satisfy all of the following rules:**

1. **Each of the digits 1-9 must occur exactly once in each row.**
2. **Each of the digits 1-9 must occur exactly once in each column.**
3. **Each of the digits 1-9 must occur exactly once in each of the 9 3x3 sub-boxes of the grid.**

Program:

def solve\_sudoku(board):

def is\_valid(board, row, col, num):

for x in range(9):

if board[row][x] == num:

return False

for x in range(9):

if board[x][col] == num:

return False

start\_row, start\_col = 3 \* (row // 3), 3 \* (col // 3)

for i in range(3):

for j in range(3):

if board[i + start\_row][j + start\_col] == num:

return False

return True

def solve(board):

for row in range(9):

for col in range(9):

if board[row][col] == '.':

for num in map(str, range(1, 10)):

if is\_valid(board, row, col, num):

board[row][col] = num

if solve(board):

return True

board[row][col] = '.'

return False

return True

solve(board)

sudoku\_board = [

["5", "3", ".", ".", "7", ".", ".", ".", "."],

["6", ".", ".", "1", "9", "5", ".", ".", "."],

[".", "9", "8", ".", ".", ".", ".", "6", "."],

["8", ".", ".", ".", "6", ".", ".", ".", "3"],

["4", ".", ".", "8", ".", "3", ".", ".", "1"],

["7", ".", ".", ".", "2", ".", ".", ".", "6"],

[".", "6", ".", ".", ".", ".", "2", "8", "."],

[".", ".", ".", "4", "1", "9", ".", ".", "5"],

[".", ".", ".", ".", "8", ".", ".", "7", "9"]

]

solve\_sudoku(sudoku\_board)

for row in sudoku\_board:

    print(row)

The worst-case time complexity of this approach is 𝑂(981)*O*(981

4. Count and Say

**The count-and-say sequence is a sequence of digit strings defined by the recursive formula:**

* **countAndSay(1) = "1"**
* **countAndSay(n) is the way you would "say" the digit string from countAndSay(n-1), which is then converted into a different digit string.**

Program:

def count\_and\_say(n):

if n == 1:

return "1"

previous\_seq = count\_and\_say(n - 1)

result = []

count = 1

for i in range(1, len(previous\_seq)):

if previous\_seq[i] == previous\_seq[i - 1]:

count += 1

else:

result.append(str(count))

result.append(previous\_seq[i - 1])

count = 1

result.append(str(count))

result.append(previous\_seq[-1])

return ''.join(result)

for i in range(1, 6):

print(f"countAndSay({i}) = {count\_and\_say(i)}")

the time complexity for generating each term is 𝑂(𝐿(𝑛−1))*O*(*L*(*n*−1))

5. . Combination Sum

**Given an array of distinct integers candidates and a target integer target, return *a list of all unique combinations of* candidates *where the chosen numbers sum to* target*.* You may return the combinations in any order.**

Program:

def combinationSum(candidates, target):

def backtrack(remaining, start, path):

if remaining == 0:

result.append(list(path))

return

elif remaining < 0:

return

for i in range(start, len(candidates)):

path.append(candidates[i])

backtrack(remaining - candidates[i], i, path)

path.pop()

result = []

candidates.sort()

backtrack(target, 0, [])

return result

candidates = [2, 3, 6, 7]

target = 7

print(combinationSum(candidates, target))

the overall time complexity is 𝑂(𝑁log⁡𝑁+2𝑁)*O*(*N*log*N*+2*N*)

6. Combination Sum II

**Given a collection of candidate numbers (candidates) and a target number (target), find all unique combinations in candidates where the candidate numbers sum to target.**

**Each number in candidates may only be used once in the combination.**

**Note: The solution set must not contain duplicate combinations**

**Program:**

def combinationSum2(candidates, target):

def backtrack(remaining, start, path):

if remaining == 0:

result.append(list(path))

return

elif remaining < 0:

return

for i in range(start, len(candidates)):

if i > start and candidates[i] == candidates[i - 1]:

continue # Skip duplicates

path.append(candidates[i])

backtrack(remaining - candidates[i], i + 1, path)

path.pop()

result = []

candidates.sort()

backtrack(target, 0, [])

return result

candidates = [10, 1, 2, 7, 6, 1, 5]

target = 8

print(combinationSum2(candidates, target))

7. Permutations II

**Given a collection of numbers, nums, that might contain duplicates, return *all possible unique permutations in any order.***

Program:

def permuteUnique(nums):

def backtrack(start):

if start == len(nums):

result.append(nums[:])

return

seen = set()

for i in range(start, len(nums)):

if nums[i] in seen:

continue

seen.add(nums[i])

nums[start], nums[i] = nums[i], nums[start]

backtrack(start + 1)

nums[start], nums[i] = nums[i], nums[start]

result = []

nums.sort()

backtrack(0)

return result

nums = [1, 1, 2]

print(permuteUnique(nums))