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### Day – 9 Recursion

**Problem Statement:** Given an array print all the sum of the subset generated from it, in the increasing order.

```
def print_subset_sums(arr):
```

```
    n = len(arr)
```

```
    subset_sums = []
```

```
    def generate_subsets(curr_sum, idx):
```

```
        if idx == n:
```

```
            subset_sums.append(curr_sum)
```

```
            return
```

```
            generate_subsets(curr_sum + arr[idx], idx + 1)
```

```
            generate_subsets(curr_sum, idx + 1)
```

```
    generate_subsets(0, 0)
```

```
    subset_sums.sort()
```

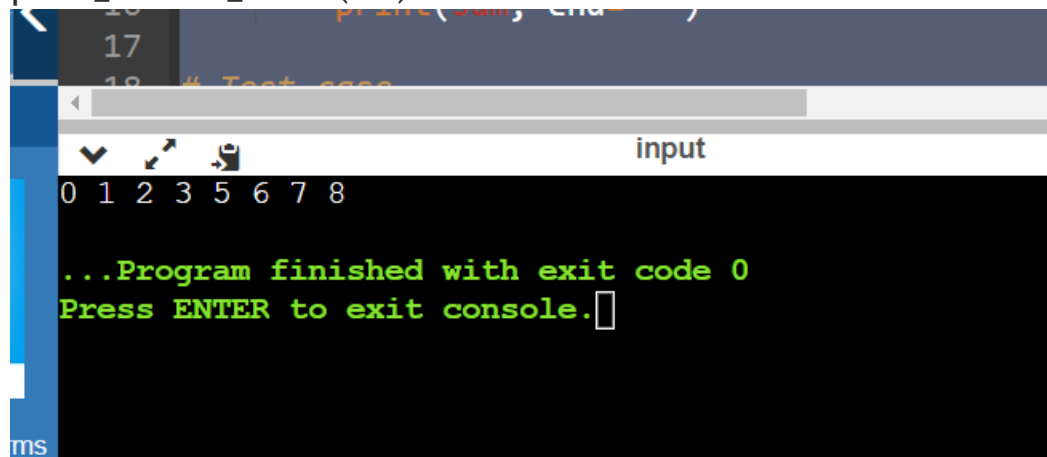
```
    for sum in subset_sums:
```

```
        print(sum, end=" ")
```

```
# Test case
```

```
arr = [5, 2, 1]
```

```
print_subset_sums(arr)
```



```
16 print_subset_sums(arr)
17
18 # Test case
input
0 1 2 3 5 6 7 8
...Program finished with exit code 0
Press ENTER to exit console.
```

---

**Problem Statement:** Given an array of integers that may contain duplicates the task is to return all possible subsets. Return only unique subsets and they can be in any order

```
def subsets_with_duplicates(nums):
```

```
    nums.sort()
```

```
    subsets = []
```

```
    generate_subsets(nums, 0, [], subsets)
```

```
    return subsets
```

```
def generate_subsets(nums, index, current, subsets):
```

```
    subsets.append(current[:])
```

```
    for i in range(index, len(nums)):
```

```
        if i > index and nums[i] == nums[i - 1]:
```

```
            continue
```

```
        current.append(nums[i])
```

```
        generate_subsets(nums, i + 1, current, subsets) # Generate subsets recursively
```

```
        current.pop()
```

```
nums = [1, 2, 2]
```

```
result = subsets_with_duplicates(nums)
```

```
print(result)
```

```
17 result = subsets_with_duplicates(nums)
18 print(result)

input
[[], [1], [1, 2], [1, 2, 2], [2], [2, 2]]

...Program finished with exit code 0
Press ENTER to exit console.
```

---

## Problem Statement:

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

The same number may be chosen from the given array an unlimited number of times. Two combinations are unique if the frequency of at least one of the chosen numbers is different.

It is guaranteed that the number of unique combinations that sum up to **target** is less than **150** combinations for the given input.

```
def combinationSum(candidates, target):
```

```
    results = []
```

```
    backtrack(candidates, target, [], results)
```

```
    return results
```

```
def backtrack(candidates, target, combination, results):
```

```
    if target < 0:
```

```
        return
```

```
    if target == 0:
```

```
        results.append(combination)
```

```

        return

    for i in range(len(candidates)):
        num = candidates[i]
        backtrack(candidates[i:], target - num, combination + [num], results)

array = [2, 3, 6, 7]
target = 7
result = combinationSum(array, target)
print(result)

```

```

input
[[2, 2, 3], [7]]

...Program finished with exit code 0
Press ENTER to exit console.

```

**Problem Statement:** 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.

```

def combinationSum2(candidates, target):
    candidates.sort()
    result = []

    def backtrack(combination, remaining, start):
        if remaining == 0:
            result.append(combination)
            return
        if remaining < 0 or start == len(candidates):
            return

```

```

for i in range(start, len(candidates)):
    if i > start and candidates[i] == candidates[i - 1]:
        continue

    candidate = candidates[i]
    if candidate > remaining:
        break

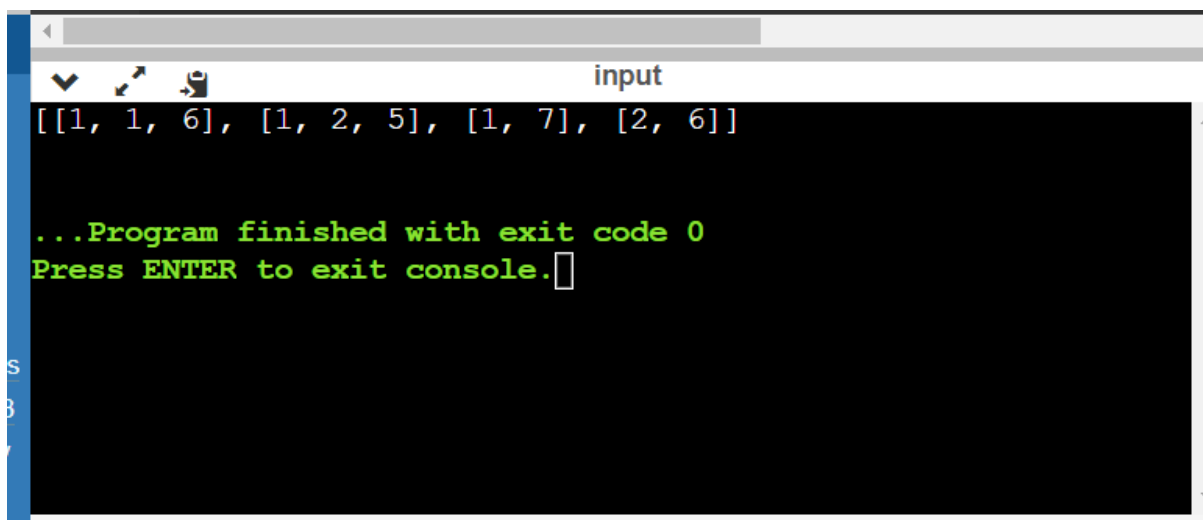
    backtrack(combination + [candidate], remaining - candidate, i + 1)

backtrack([], target, 0)

return result

candidates = [10, 1, 2, 7, 6, 1, 5]
target = 8
result = combinationSum2(candidates, target)
print(result)

```



```

input
[[1, 1, 6], [1, 2, 5], [1, 7], [2, 6]]

...Program finished with exit code 0
Press ENTER to exit console.

```

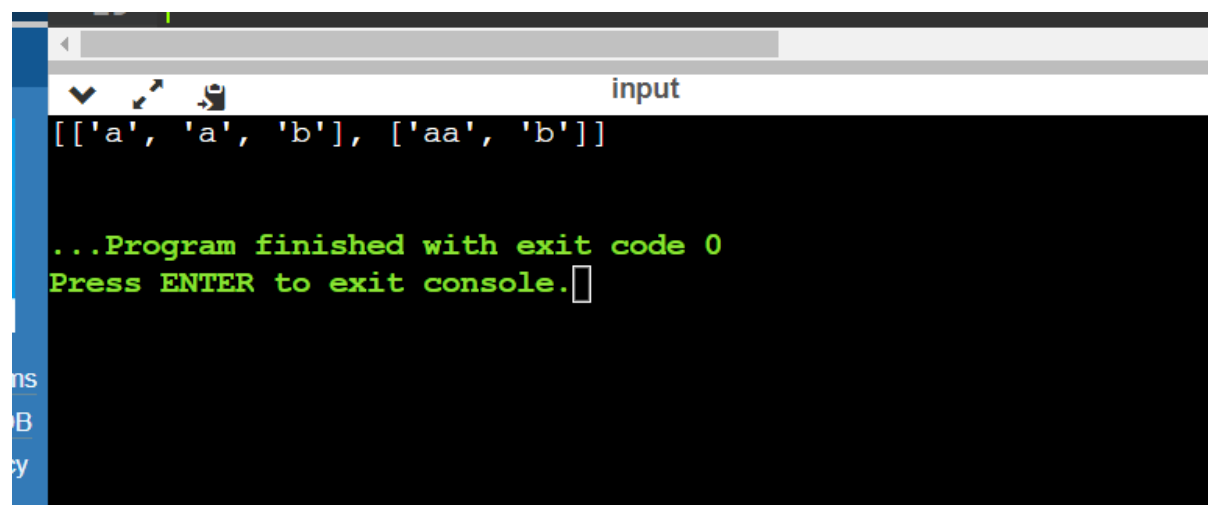
**Problem Statement:** You are given a string *s*, partition it in such a way that every substring is a palindrome. Return all such palindromic partitions of *s*.

```

def is_palindrome(string):
    return string == string[::-1]

```

```
def partition_palindrome(s):  
    result = []  
    current_partition = []  
  
    def backtrack(start):  
        if start >= len(s):  
            result.append(current_partition[:])  
            return  
  
        for end in range(start, len(s)):  
            substring = s[start:end+1]  
            if is_palindrome(substring):  
                current_partition.append(substring)  
                backtrack(end+1)  
                current_partition.pop()  
  
    backtrack(0)  
    return result  
  
s = "aab"  
result = partition_palindrome(s)  
print(result)
```



The screenshot shows a terminal window with a dark background. At the top, there's a title bar with the word "input". Below it, the output of the program is displayed in white text: `[['a', 'a', 'b'], ['aa', 'b']]`. Below the output, there's a green message: `...Program finished with exit code 0` and a prompt: `Press ENTER to exit console.` with a cursor. On the left side of the terminal, there's a vertical blue bar with some text partially visible: "ns", "B", and "cy".

**Problem Statement:** Given N and K, where N is the sequence of numbers from 1 to N([1,2,3.... N]) find the Kth permutation sequence.

```
def getPermutation(N, K):
```

```
    numbers = list(range(1, N+1))
```

```
    result = "
```

```
def findPermutation(n, k):
```

```
    nonlocal numbers, result
```

```
    if n == 1:
```

```
        result += str(numbers[0])
```

```
        return
```

```
    factorial = 1
```

```
    for i in range(2, n):
```

```
        factorial *= i
```

```
    index = (k - 1) // factorial
```

```
    result += str(numbers[index])
```

```
    numbers.pop(index)
```

```
    k -= index * factorial
```

```
    findPermutation(n - 1, k)
```

```
findPermutation(N, K)
```

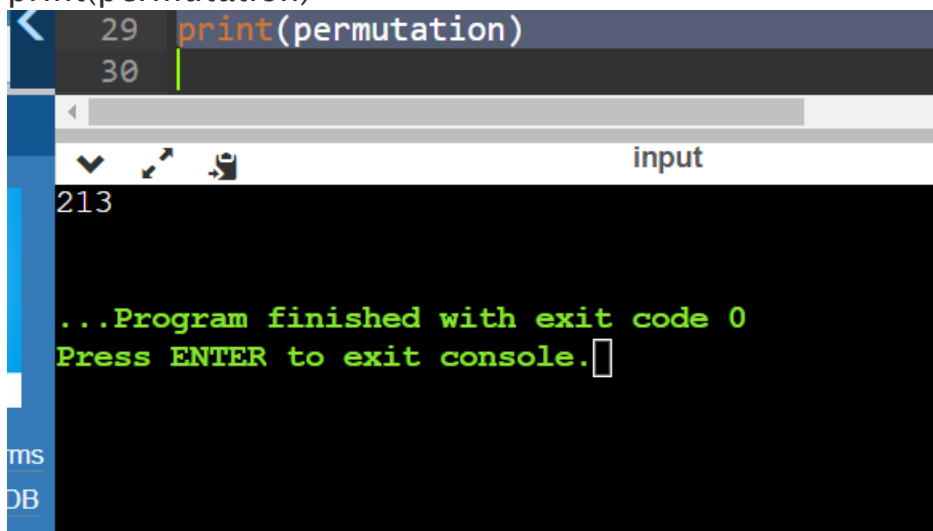
```
return result
```

```
N = 3
```

```
K = 3
```

```
permutation = getPermutation(N, K)
```

```
print(permutation)
```



The screenshot shows a code editor with two lines of code: line 29 contains `print(permutation)` and line 30 is empty. Below the editor is a console window. The console has a title bar with a checkmark, a refresh icon, and a document icon, and the text "input". The console output shows the number "213" on the first line. The second line is a green message: "...Program finished with exit code 0". The third line is also green: "Press ENTER to exit console." followed by a cursor. On the left side of the console, there is a vertical blue bar with the text "ms" and "DB" visible.

```
29 print(permutation)
30
```

input

213

...Program finished with exit code 0  
Press ENTER to exit console.

ms  
DB