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5B32(21)

1. Implementation of Merge Sort. TC: O(n log n)

- Solution Code :

```
def merge(left, right):
    merged = []
    i = j = 0
    while i < len(left) and j < len(right):
        if left[i] <= right[j]:
            merged.append(left[i])
            i += 1
        else:
            merged.append(right[j])
            j += 1
    while i < len(left):
        merged.append(left[i])
        i += 1
    while j < len(right):
        merged.append(right[j])
        j += 1
    return merged
def merge_sort(arr):
    if len(arr) <= 1:
        return arr
    mid = len(arr) // 2
    left_half = merge_sort(arr[:mid])
    right_half = merge_sort(arr[mid:])
    return merge(left_half, right_half)
arr = [11,18,5,9,27,4,23,20]
sorted_arr = merge_sort(arr)
print("Sorted array:", sorted_arr)
```

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- Output :

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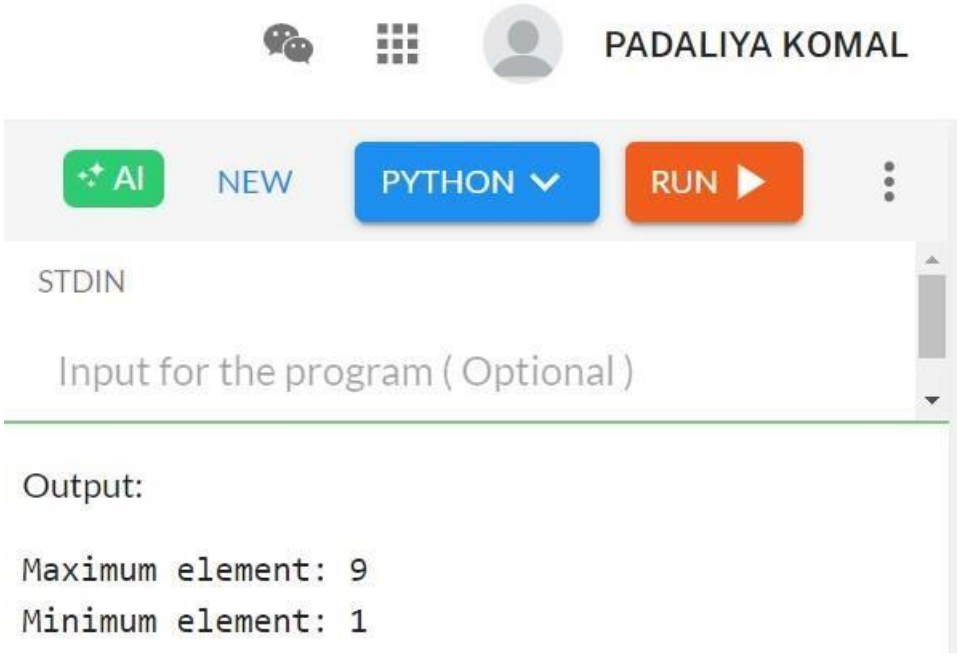
2. Implementation of Max-Min by using Divide and Conquer principal TC: O(n)

- Solution code :

```
def find_max_min(arr, low, high):
    if low == high:
        return arr[low], arr[low]
    elif high == low + 1:
        if arr[low] > arr[high]:
            return arr[low], arr[high]
        else:
            return arr[high], arr[low]
    mid = (low + high) // 2
    max1, min1 = find_max_min(arr, low, mid)
    max2, min2 = find_max_min(arr, mid + 1, high)
    overall_max = max(max1, max2)
    overall_min = min(min1, min2)
    return overall_max, overall_min
arr = [3, 5, 1, 8, 9, 2, 7, 6]
n = len(arr)
maximum, minimum = find_max_min(arr, 0, n - 1)
print(f"Maximum element: {maximum}")
print(f"Minimum element: {minimum}")
```

- Output :

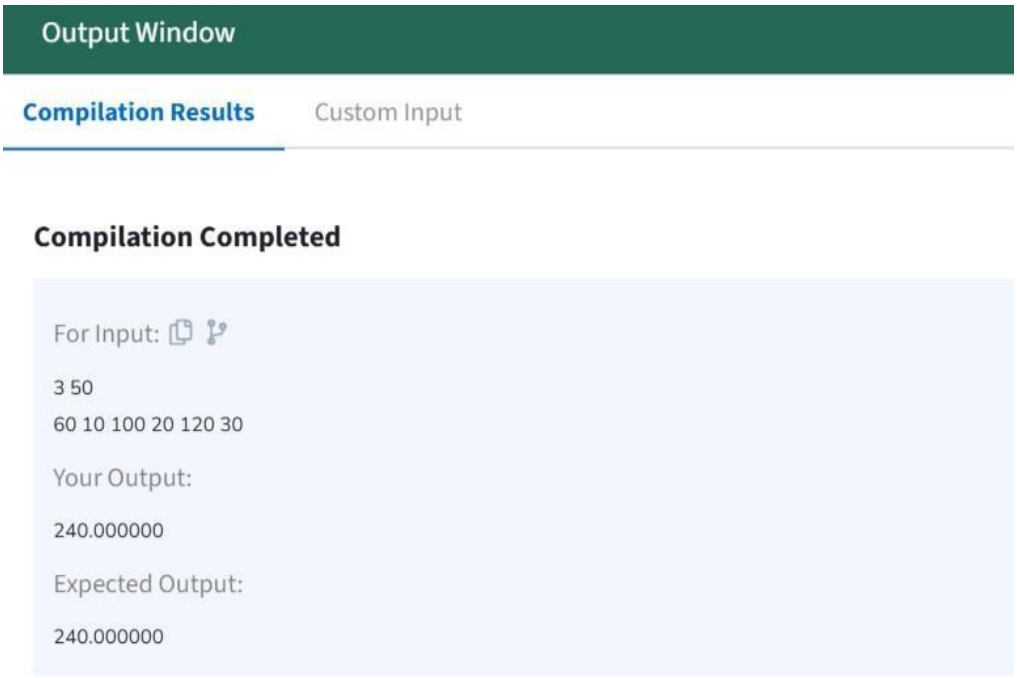

PADALIYA KOMAL
AI
NEW
PYTHON
RUN
STDIN
Input for the program (Optional)
Output:
Maximum element: 9
Minimum element: 1

3. **Fractional Knapsack GeeksForGeeks Implementation of Fractional KnapSack TC: O(n log n) (Problem Statement: The weight of N items and their corresponding values are given. We have to put these items in a knapsack of weight W such that the total value obtained is maximized.)**

- Solution Code :

```
class Item:     def
__init__(self,val,w):
self.value = val
self.weight = w         class
Solution:
   #Function to get the maximum total value in the knapsack.
def fractionalknapsack(self, w,arr,n):
       prof = [arr[i].value / arr[i].weight for i in range(n)]
items = [[prof[i], arr[i].value, arr[i].weight] for i in range(n)]
items.sort(key=lambda x: x[0], reverse=True)        profit = 0
i = 0         while w > 0 and i < n:              if items[i][2] <= w:
profit += items[i][1]                 w -= items[i][2]            else:
              profit += items[i][0] * w
w = 0
          i += 1
return profit
```

- Output :


Output Window
Compilation Results
Custom Input
Compilation Completed
For Input:
3 50
60 10 100 20 120 30
Your Output:
240.000000
Expected Output:
240.000000

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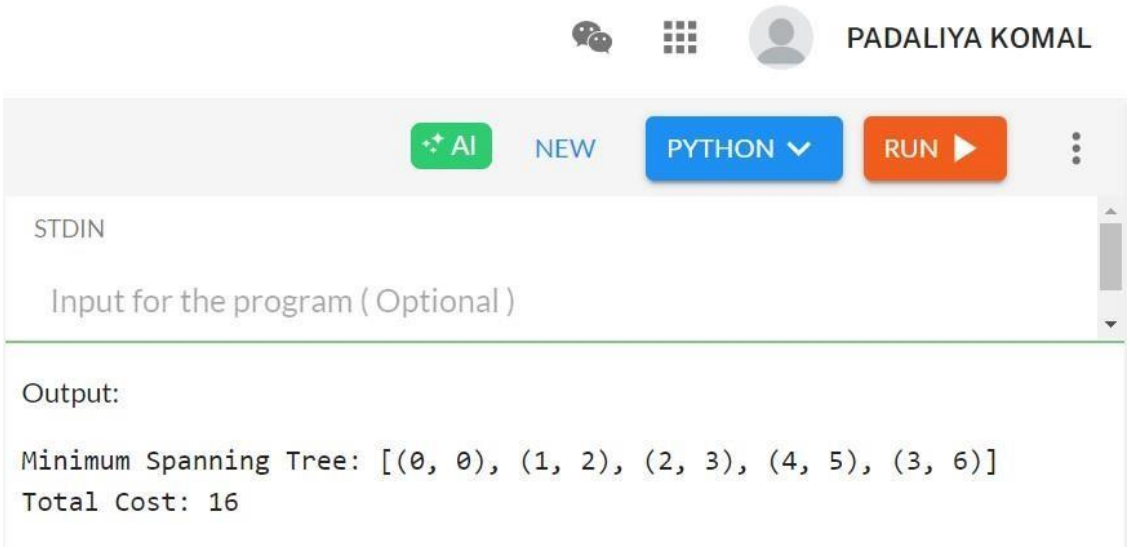
Implementation of Prim's Algorithm.

- Solution code : import heapq def prim(graph, start): mst = [] visited = set() min_heap = [(0, start)] total_cost = 0 while min_heap: cost, node = heapq.heappop(min_heap)
  if node in visited: continue visited.add(node)
  total_cost += cost mst.append((node, cost)) for neighbor, weight in graph[node]: if neighbor not in visited: heapq.heappush(min_heap, (weight, neighbor)) return mst, total_cost graph = {0: [(1, 2), (3, 6)],1: [(0,
  2), (2, 3), (3, 8), (4, 5)], 2: [(1, 3), (4, 7)],3: [(0, 6), (1,
  8)],4: [(1, 5), (2, 7)]} mst, total_cost = prim(graph, 0) print("Minimum Spanning Tree:", mst) print("Total Cost:", total_cost)

- Output :



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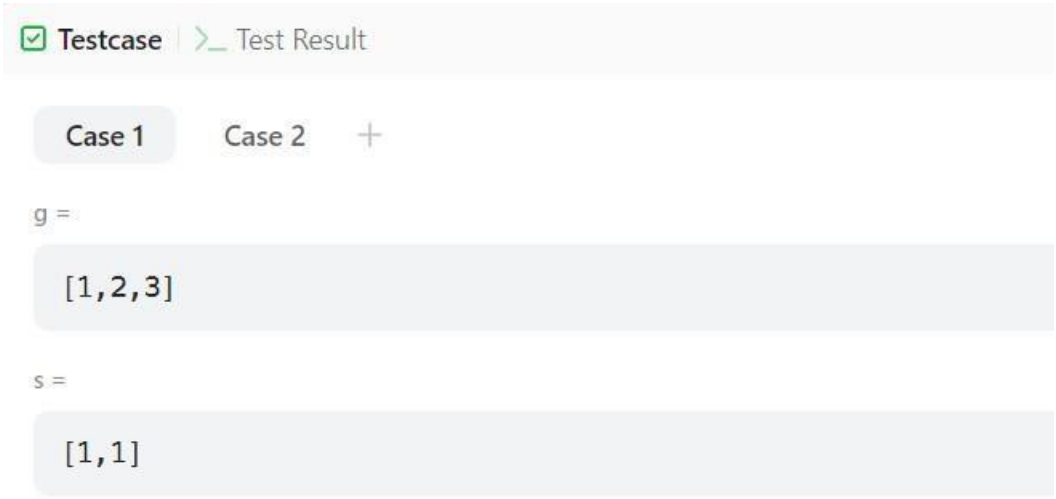
5B32(21)

Assign Cookies. (Assume you are an awesome parent and want to give your children some cookies. But, you should give each child at most one cookie.) Leetcode problem number: 455

- Solution code :

```
def find_content_children(g,s):     g.sort()
    s.sort()     i=j=0     while
i<len(g) and j<len(s):         if s[j]
>= g[i]:
            i+=1
j+=1         return
i
g=list(map(int,input().split()))
s=list(map(int,input().split())) result=find_content_children(g,s)
print(result)
```

- Output :



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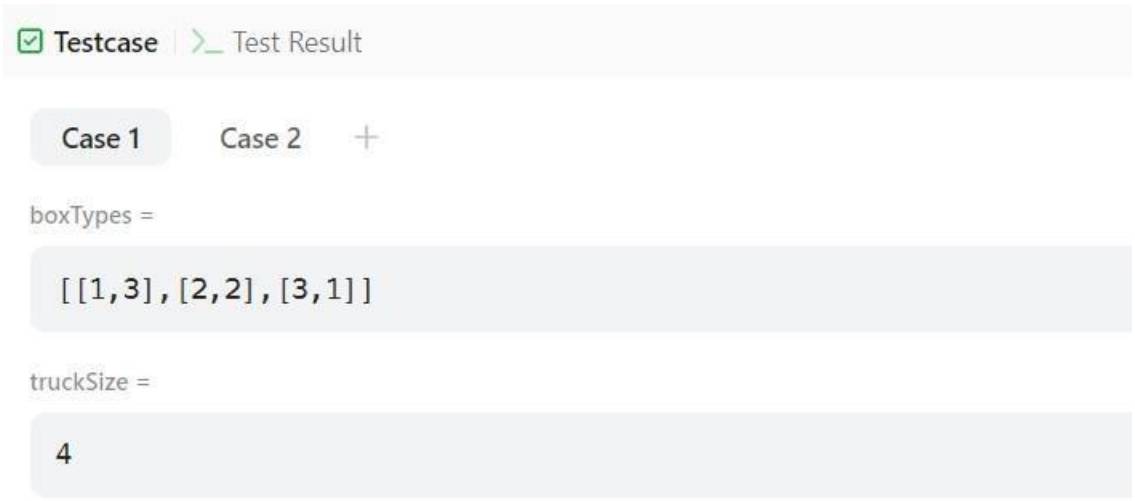
5B32(21)

Maximum Units on a Truck. Leetcode problem number: 1710

- Solution code : class Solution: def maximumUnits(self, boxTypes: List[List[int]], truckSize: int) -> int:

```
        boxTypes.sort(key=lambda X : X[1],reverse=True)
    total_units=0        for box_count,unit in boxTypes:            if
    truckSize == 0:
                break            if box_count<=truckSize:
    total_units += box_count * units                truckSize
    -= box_count            else:
                total_units += truckSize * units
    truckSize = 0
     return total_units
```

- Output :



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5B32(21)

Lemonade Change. Leetcode problem number: 860

- Solution code :

```
class Solution:
    def lemonadeChange(self, bills: List[int]) -> bool:
        five, ten = 0, 0
        for bill in bills:
            if bill == 5:
                five += 1
            elif bill == 10:
                if five > 0:
                    five -= 1
                    ten += 1
                else:
                    return False
            elif bill == 20:
                if ten > 0 and five > 0:
                    ten -= 1
                    five -= 1
                elif five >= 3:
                    five -= 3
                else:
                    return False
        return True
```

- Output :

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5B32(21)

Merge Intervals Leetcode problem number: 56

- Solution code :

```
class Solution:     def merge(self, intervals: List[List[int]]) -
> List[List[int]]:          intervals.sort(key=lambda x: x[0])
merged = []         for interval in intervals:              if not
merged or merged[-1][1] < interval[0]:
merged.append(interval)
else:                   merged[-1][1] = max(merged[-1][1],
interval[1])
return merged
```

- Output :

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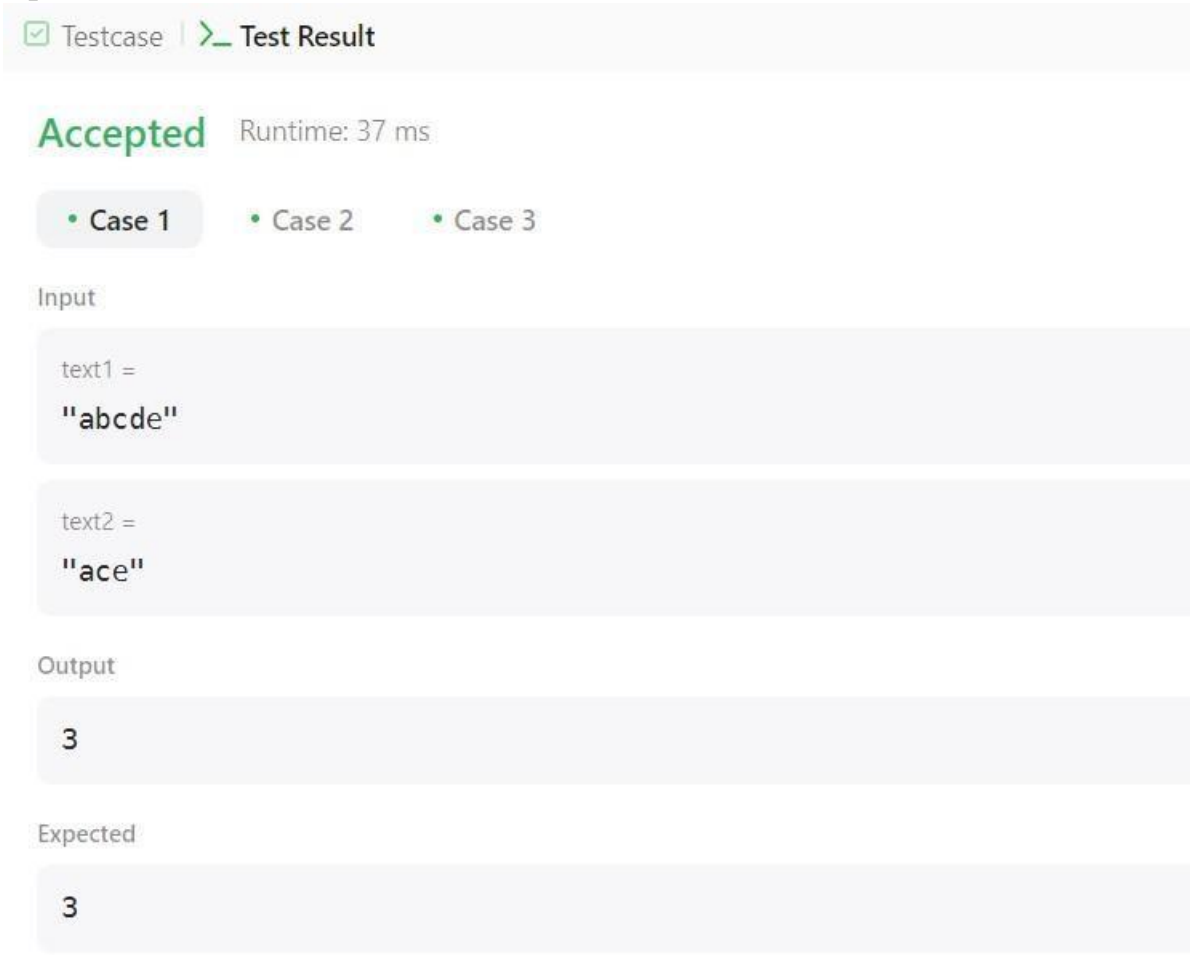
5B32(21)

LCS LeetCode problem number 1143

- Solution code :

```
class Solution:        def longestCommonSubsequence(self, text1: str,
text2: str) -> int:
            m, n = len(text1), len(text2)            dp =
[[0] * (n + 1) for _ in range(m + 1)]            for i in
range(1, m + 1):                for j in range(1, n
+ 1):                    if text1[i - 1] == text2[j - 1]:
dp[i][j] = dp[i - 1][j - 1] + 1                    else:
                    dp[i][j] = max(dp[i - 1][j], dp[i][j - 1])
return dp[m][n]
```

- Output :



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5B32(21)

Number of Coins GeeksForGeeks

- Solution code : class Solution: def minCoins(self, coins, M, sum): k = float("inf") dp = [[k for _ in range(sum + 1)] for _ in range(M + 1)] for i in range(1, M + 1): dp[i][0]=0 for i in range(1, M + 1): for j in range(1, sum + 1): if coins[i - 1] <= j: dp[i][j] = min(dp[i][j - coins[i - 1]] + 1, dp[i - 1][j]) else: dp[i][j] = dp[i - 1][j] if dp[M][sum] == k: return -1 return dp[M][sum] if __name__ == '__main__': T = int(input()) for i in range(T): v, m = input().split() v, m = int(v), int(m) coins = [int(x) for x in input().split()] ob = Solution() ans = ob.minCoins(coins, m, v) print(ans)

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5B32(21)

- Output :