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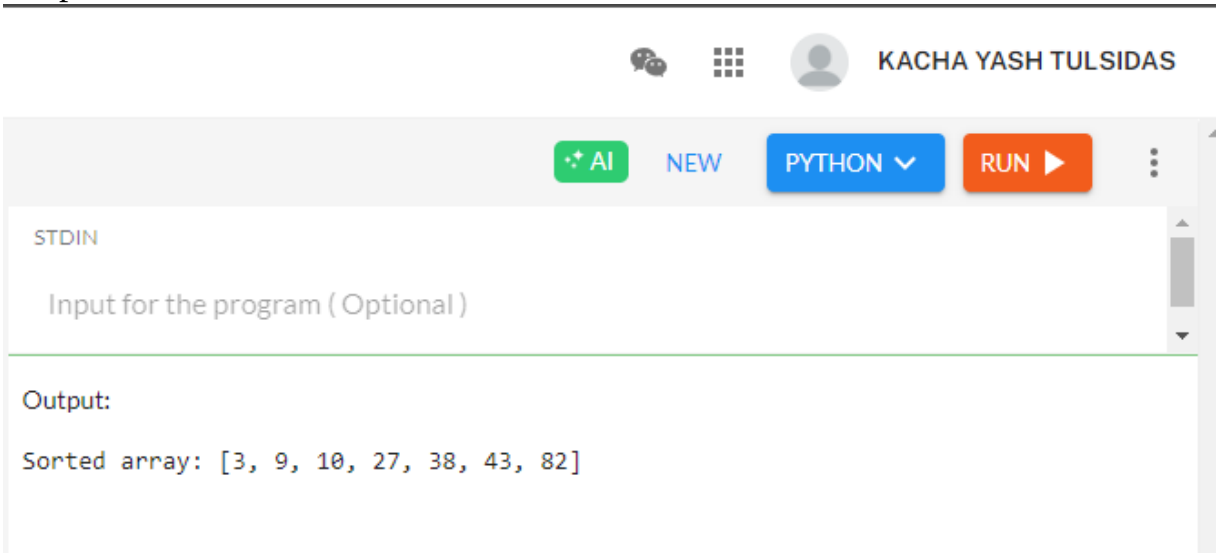
5B32(31)

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)
```

- Output :


KACHA YASH TULSIDAS
AI
NEW
PYTHON
RUN
STDIN
Input for the program (Optional)
Output:
Sorted array: [3, 9, 10, 27, 38, 43, 82]

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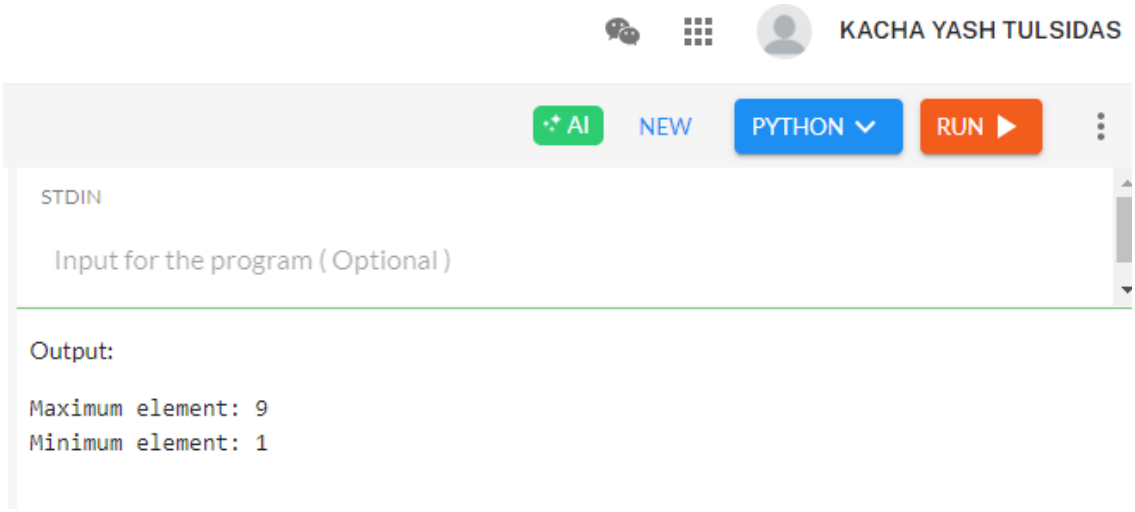
2. Implementation of Max-Min by using Divide and Conquer principal TC: O(n)

- 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 :

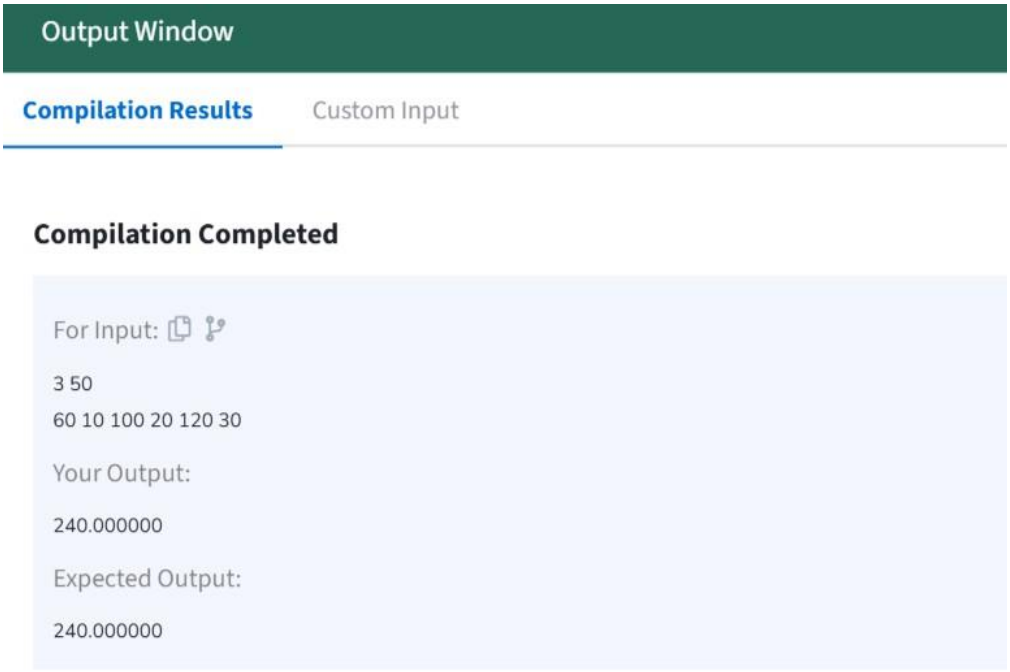


3. **Fractional Knapsack GeeksForGeeks Implementation of Fractional KnapSack TC: O(n log n) (Problem Statement: The weight of N items and their corresponding values are given. We have to put these items in a knapsack of weight W such that the total value obtained is maximized.)**

- 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

4. 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 :

5. **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)
```

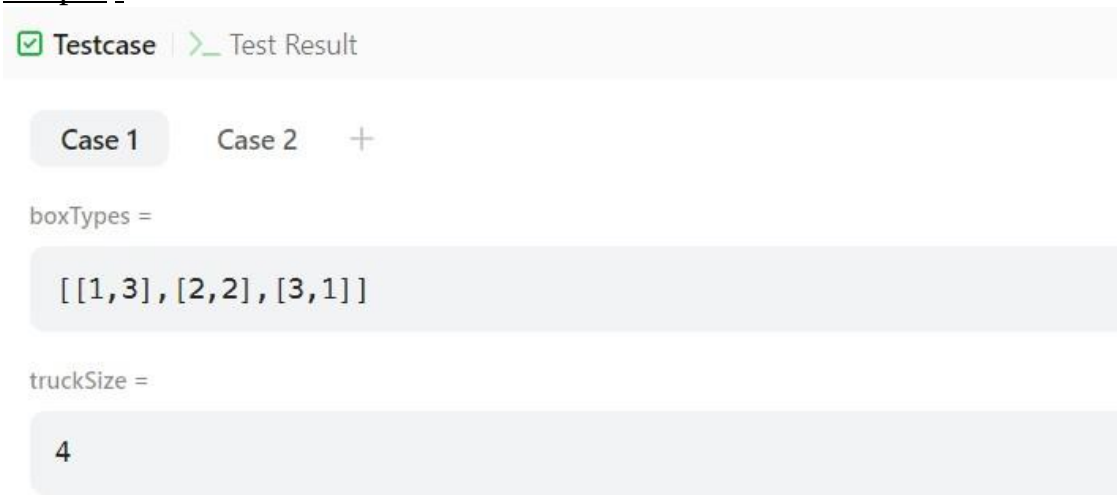
- Output :

6. 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 :



7. 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 :


Testcase
Test Result
Accepted
Runtime: 47 ms
Case 1
Case 2
Input
bills =
[5,5,5,10,20]
Output
true
Expected
true

8. 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
```

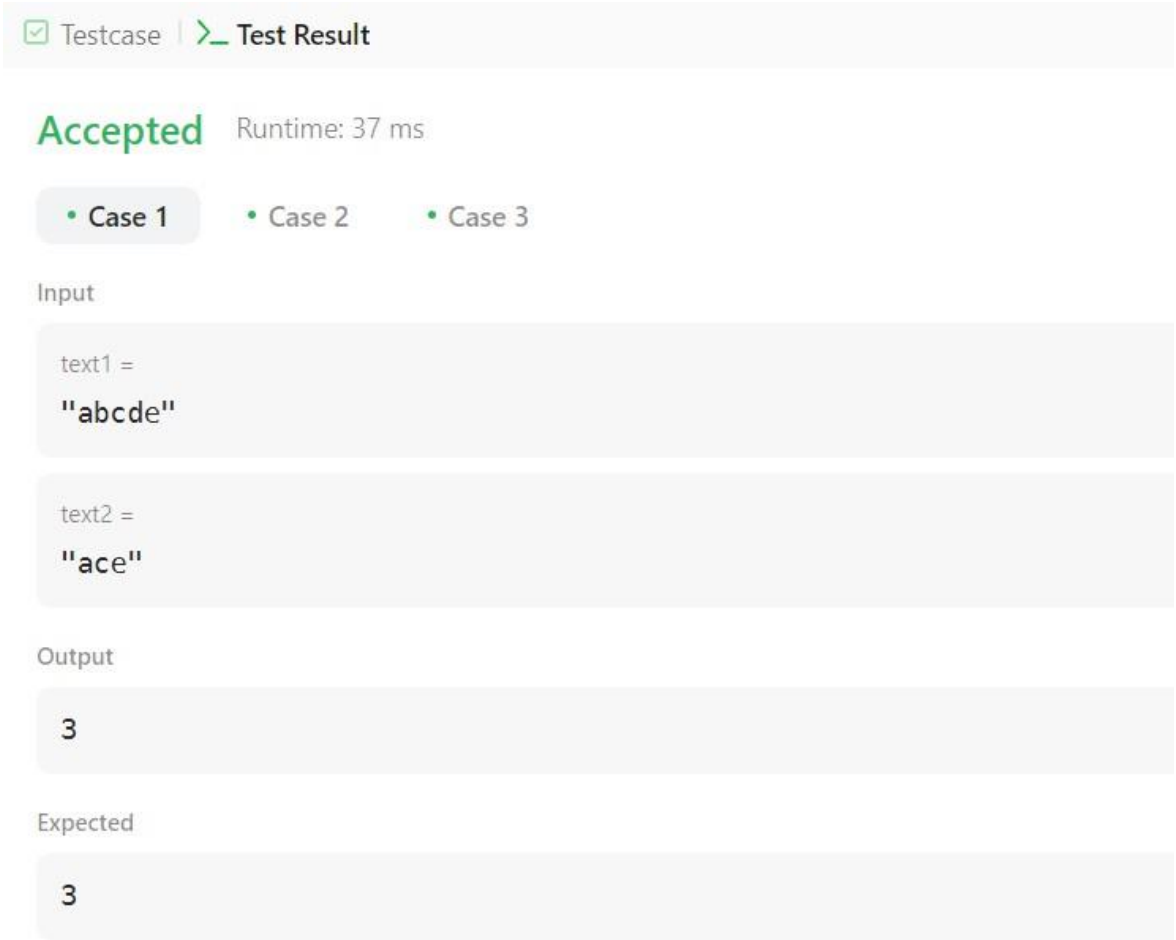
- Output :

9. 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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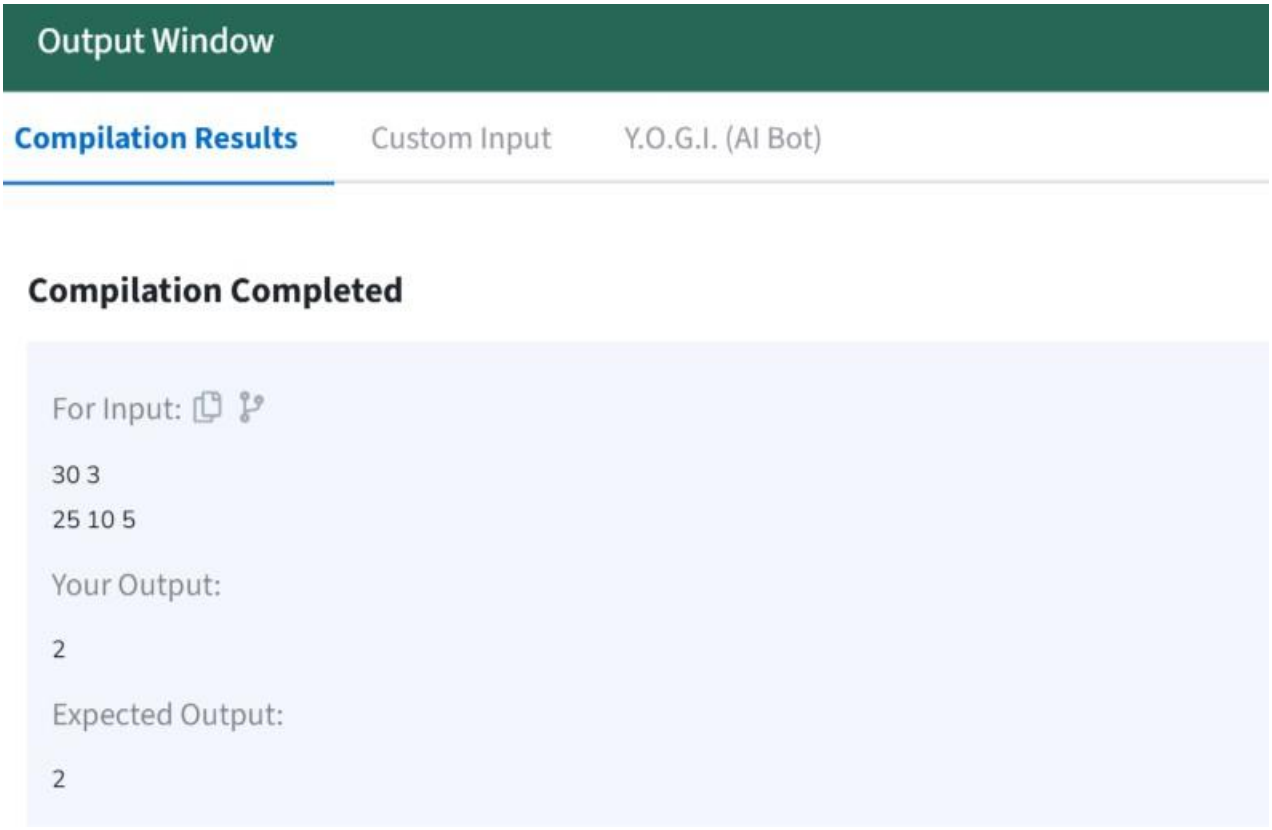
10. Number of Coins GeeksForGeeks

- 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)
```

- Output :


Output Window
Compilation Results
Custom Input
Y.O.G.I. (AI Bot)
Compilation Completed
For Input:
30 3
25 10 5
Your Output:
2
Expected Output:
2