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# Program #1 Part 1

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## Date: 10-20-21
## Assignment #3

# Description: This program will use a function to sort an array of integers in increasing or


def mergesort(arr):
  if len(arr) > 1:
    middle = len(arr) // 2    # This will be the middle number within the array
    left = arr[:middle]
    right = arr[middle:]

    # Calling merge sort Function to divide the array's left and right side recursively
    mergesort(left)
    mergesort(right)




  # Setting index to zero for each list to the left most
    i = 0  # left side's leftmost index
    j = 0  # right side's leftmost index
    merged_array = 0  # This is the merged array index to store both left and right side of t

    # Merging of the individual lists
    while i < len(left) and j < len(right):
      if left[i] <= right[j]:
        arr[merged_array] = left[i]
        i = i + 1  # This moves to the next element within the left side of array
      else:
        arr[merged_array] = right[j]
        j = j + 1   # This moves to the next element within the right side of array
      merged_array += 1     # This will increase the length of the merged array in every whil


    # Obtaining remaining numbers
    while i < len(left):
      arr[merged_array] = left[i]
      i += 1
      merged_array += 1

    while j < len(right):
      arr[merged_array] = right[j]
      j += 1
      merged_array += 1
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        merged_array += 1
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# Line Separation
print("----------- Part A (Length of 16 Integers) ----------- ")

# Declaring an array with Length of 16 elements
A = [2, 4, 3, 5, 1, 6, 10, 11, 7, 8, 16, 9, 12, 13, 15, 14]
print("Original Array: ")
print(A)

# Empty Space
print("")

# Calling mergesort function to sort arr of length 16
mergesort(A)
print("Sorted Array: ")
print(A)

# Empty Space
print("")


# Line Seperation
print("----------------- Part B (array of length 2^20) Part 2----------------- ")

# Importing Random function to produce a random account of numbers
import random

# Setting a random seed so every time the program is ran the output of random numbers will al
random.seed(0)

# Creating an array of length 2^20 of random integers
B = [random.randint(0, 10**7) for i in range(2**20)]

#Empty Space
print("")

# Declaring variables for indexed numbers within the array
C = B[0:5]
D = B[10000:10005]


# Printing out Unsorted numbers
print("Unsorted Arrays: ")
print(C)
print(D)
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# Calling Merge Function for C and D
mergesort(C)
mergesort(D)

#Empty Space
print("")

# Printing out Sorted Numbers in increasing order
print("Sorted Arrays: ")
print(C)
print(D)
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