

Outputs:

Question 1:

A

```
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)

4 total = array_sum(A, 0, len(A) - 1)
5 print(f"\nFinal Sum: {total}")
6 print(f"\nTotal sums executed: {sum_counter}")

Recursive call on array: [38, 21, 39, 60, -1, 10, 81, 23]
Recursive call on array: [38, 21, 39, 60]
Recursive call on array: [38, 21]
Recursive call on array: [38]
Return 38
Recursive call on array: [21]
Return 21
sum counted 1
Return 38 + 21 = 59
Recursive call on array: [39, 60]
Recursive call on array: [39]
Return 39
Recursive call on array: [60]
Return 60
sum counted 2
Return 39 + 60 = 99
sum counted 3
Return 59 + 99 = 158
Recursive call on array: [-1, 10, 81, 23]
Recursive call on array: [-1, 10]
Recursive call on array: [-1]
Return -1
Recursive call on array: [10]
Return 10
sum counted 4
Return -1 + 10 = 9
Recursive call on array: [81, 23]
Recursive call on array: [81]
Return 81
Recursive call on array: [23]
Return 23
sum counted 5
Return 81 + 23 = 104
sum counted 6
Return 9 + 104 = 113
sum counted 7
Return 158 + 113 = 271

Final Sum: 271

Total sums executed: 7
```

B:

```
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel) ○

Recursive call on array: [2, 97, 5, 88, 9, 72, 12, 64, 17, 56, 21]
Recursive call on array: [2, 97, 5, 88, 9, 72]
Recursive call on array: [2, 97, 5]
Recursive call on array: [2, 97]
Recursive call on array: [2]
Return 2
Recursive call on array: [97]
Return 97
sum counted 1
Return 2 + 97 = 99
Recursive call on array: [5]
Return 5
sum counted 2
Return 99 + 5 = 104
Recursive call on array: [88, 9, 72]
Recursive call on array: [88, 9]
Recursive call on array: [88]
Return 88
Recursive call on array: [9]
Return 9
sum counted 3
Return 88 + 9 = 97
Recursive call on array: [72]
Return 72
sum counted 4
Return 97 + 72 = 169
sum counted 5
Return 104 + 169 = 273
Recursive call on array: [12, 64, 17, 56, 21]
Recursive call on array: [12, 64, 17]
Recursive call on array: [12, 64]
Recursive call on array: [12]
Return 12
Recursive call on array: [64]
Return 64
sum counted 6
Return 12 + 64 = 76
Recursive call on array: [17]
Return 17
sum counted 7
Return 76 + 17 = 93
Recursive call on array: [56, 21]
Recursive call on array: [56]
Return 56
Recursive call on array: [21]
Return 21
sum counted 8
Return 56 + 21 = 77
sum counted 9
Return 93 + 77 = 170
sum counted 10
Return 273 + 170 = 443

Final Sum: 443

Total sums executed: 10
```

C:

```
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)

Recursive call on array: [100, 33, 22, 213, 65, 29, 153, 199, 47, 181, 85]
Recursive call on array: [100, 33, 22, 213, 65, 29]
Recursive call on array: [100, 33, 22]
Recursive call on array: [100, 33]
Recursive call on array: [100]
Return 100
Recursive call on array: [33]
Return 33
sum counted 1
Return 100 + 33 = 133
Recursive call on array: [22]
Return 22
sum counted 2
Return 133 + 22 = 155
Recursive call on array: [213, 65, 29]
Recursive call on array: [213, 65]
Recursive call on array: [213]
Return 213
Recursive call on array: [65]
Return 65
sum counted 3
Return 213 + 65 = 278
Recursive call on array: [29]
Return 29
sum counted 4
Return 278 + 29 = 307
sum counted 5
Return 155 + 307 = 462
Recursive call on array: [153, 199, 47, 181, 85]
Recursive call on array: [153, 199, 47]
Recursive call on array: [153, 199]
Recursive call on array: [153]
Return 153
Recursive call on array: [199]
Return 199
sum counted 6
Return 153 + 199 = 352
Recursive call on array: [47]
Return 47
sum counted 7
Return 352 + 47 = 399
Recursive call on array: [181, 85]
Recursive call on array: [181]
Return 181
Recursive call on array: [85]
Return 85
sum counted 8
Return 181 + 85 = 266
sum counted 9
Return 399 + 266 = 665
sum counted 10
Return 462 + 665 = 1127

Final Sum: 1127

Total sums executed: 10
```

Question 2:

A

```
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel) ○

37 B = [2, 97, 5, 88, 9, 72, 12, 64, 17, 56, 21]
38 C = [100, 33, 22, 213, 65, 29, 153, 199, 47, 181, 85]
39 sorted_array = mergesort(A)
40 print("Sorted Array:", sorted_array)
41

mergesort input array : [38, 21, 39, 60, -1, 10, 81, 23]
mergesort input array : [38, 21, 39, 60]
mergesort input array : [38, 21]
mergesort input array : [38]
mergesort output array: [38]
mergesort input array : [21]
mergesort output array: [21]
merge input array : [38], [21]
merge output array : [21, 38]
mergesort output array: [21, 38]
mergesort input array : [39, 60]
mergesort input array : [39]
mergesort output array: [39]
mergesort input array : [60]
mergesort output array: [60]
merge input array : [39], [60]
merge output array : [39, 60]
mergesort output array: [39, 60]
merge input array : [21, 38], [39, 60]
merge output array : [21, 38, 39, 60]
mergesort output array: [21, 38, 39, 60]
mergesort input array : [-1, 10, 81, 23]
mergesort input array : [-1, 10]
mergesort input array : [-1]
mergesort output array: [-1]
mergesort input array : [10]
mergesort output array: [10]
merge input array : [-1], [10]
merge output array : [-1, 10]
mergesort output array: [-1, 10]
mergesort input array : [81, 23]
mergesort input array : [81]
mergesort output array: [81]
mergesort input array : [23]
mergesort output array: [23]
merge input array : [81], [23]
merge output array : [23, 81]
mergesort output array: [23, 81]
merge input array : [-1, 10], [23, 81]
merge output array : [-1, 10, 23, 81]
mergesort output array: [-1, 10, 23, 81]
merge input array : [21, 38, 39, 60], [-1, 10, 23, 81]
merge output array : [-1, 10, 21, 23, 38, 39, 60, 81]
mergesort output array: [-1, 10, 21, 23, 38, 39, 60, 81]
Sorted Array: [-1, 10, 21, 23, 38, 39, 60, 81]
```

B

```
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)

mergesort input array : [2, 97, 5, 88, 9, 72, 12, 64, 17, 56, 21]
mergesort input array : [2, 97, 5, 88, 9]
mergesort input array : [2, 97]
mergesort input array : [2]
mergesort output array: [2]
mergesort input array : [97]
mergesort output array: [97]
merge input array   : [2], [97]
merge output array  : [2, 97]
mergesort output array: [2, 97]
mergesort input array : [5, 88, 9]
mergesort input array : [5]
mergesort output array: [5]
mergesort input array : [88, 9]
mergesort input array : [88]
mergesort output array: [88]
mergesort input array : [9]
mergesort output array: [9]
merge input array   : [88], [9]
merge output array  : [9, 88]
mergesort output array: [9, 88]
merge input array   : [5], [9, 88]
merge output array  : [5, 9, 88]
mergesort output array: [5, 9, 88]
merge input array   : [2, 97], [5, 9, 88]
merge output array  : [2, 5, 9, 88, 97]
mergesort output array: [2, 5, 9, 88, 97]
mergesort input array : [72, 12, 64, 17, 56, 21]
mergesort input array : [72, 12, 64]
mergesort input array : [72]
mergesort output array: [72]
mergesort input array : [12, 64]
mergesort input array : [12]
mergesort output array: [12]
mergesort input array : [64]
mergesort output array: [64]
merge input array   : [12], [64]
merge output array  : [12, 64]
mergesort output array: [12, 64]
merge input array   : [72], [12, 64]
merge output array  : [12, 64, 72]
mergesort output array: [12, 64, 72]
mergesort input array : [17, 56, 21]
mergesort input array : [17]
mergesort output array: [17]
mergesort input array : [56, 21]
mergesort input array : [56]
mergesort output array: [56]
mergesort input array : [21]
mergesort output array: [21]
merge input array   : [56], [21]
merge output array  : [21, 56]
mergesort output array: [21, 56]
merge input array   : [17], [21, 56]
merge output array  : [17, 21, 56]
mergesort output array: [17, 21, 56]
merge input array   : [12, 64, 72], [17, 21, 56]
merge output array  : [12, 17, 21, 56, 64, 72]
mergesort output array: [12, 17, 21, 56, 64, 72]
merge input array   : [2, 5, 9, 88, 97], [12, 17, 21, 56, 64, 72]
merge output array  : [2, 5, 9, 12, 17, 21, 56, 64, 72, 88, 97]
mergesort output array: [2, 5, 9, 12, 17, 21, 56, 64, 72, 88, 97]
Sorted Array: [2, 5, 9, 12, 17, 21, 56, 64, 72, 88, 97]
```

C

```

mergesort input array : [100, 33, 22, 213, 65, 29, 153, 199, 47, 181, 85]
mergesort input array : [100, 33, 22, 213, 65]
mergesort input array : [100, 33]
mergesort input array : [100]
mergesort output array: [100]
mergesort input array : [33]
mergesort output array: [33]
merge input array   : [100], [33]
merge output array  : [33, 100]
mergesort output array: [33, 100]
mergesort input array : [22, 213, 65]
mergesort input array : [22]
mergesort output array: [22]
mergesort input array : [213, 65]
mergesort input array : [213]
mergesort output array: [213]
mergesort input array : [65]
mergesort output array: [65]
merge input array   : [213], [65]
merge output array  : [65, 213]
mergesort output array: [65, 213]
merge input array   : [22], [65, 213]
merge output array  : [22, 65, 213]
mergesort output array: [22, 65, 213]
merge input array   : [33, 100], [22, 65, 213]
merge output array  : [22, 33, 65, 100, 213]
mergesort output array: [22, 33, 65, 100, 213]
mergesort input array : [29, 153, 199, 47, 181, 85]
mergesort input array : [29, 153, 199]
mergesort input array : [29]
mergesort output array: [29]
mergesort input array : [153, 199]
mergesort input array : [153]
mergesort output array: [153]
mergesort input array : [199]
mergesort output array: [199]
merge input array   : [153], [199]
merge output array  : [153, 199]
mergesort output array: [153, 199]
merge input array   : [29], [153, 199]
merge output array  : [29, 153, 199]
mergesort output array: [29, 153, 199]
mergesort input array : [47, 181, 85]
mergesort input array : [47]
mergesort output array: [47]
mergesort input array : [181, 85]
mergesort input array : [181]
mergesort output array: [181]
mergesort input array : [85]
mergesort output array: [85]
merge input array   : [181], [85]
merge output array  : [85, 181]
mergesort output array: [85, 181]
merge input array   : [47], [85, 181]
merge output array  : [47, 85, 181]
mergesort output array: [47, 85, 181]
merge input array   : [29, 153, 199], [47, 85, 181]
merge output array  : [29, 47, 85, 153, 181, 199]
mergesort output array: [29, 47, 85, 153, 181, 199]
merge input array   : [22, 33, 65, 100, 213], [29, 47, 85, 153, 181, 199]
merge output array  : [22, 29, 33, 47, 65, 85, 100, 153, 181, 199, 213]
mergesort output array: [22, 29, 33, 47, 65, 85, 100, 153, 181, 199, 213]
Sorted Array: [22, 29, 33, 47, 65, 85, 100, 153, 181, 199, 213]

```