

Q ① Given an array of  $[4, -2, 5, 3, 10, 5, 2, 8, -3, 6, 7, -4, 1, 9, -1, 0, -6, 8, 11, 9]$  integers. Find the maximum and minimum product that can be obtained by multiplying two integers from the array.

Sol Sort the array:

$\Rightarrow [-9, -8, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]$

$\Rightarrow$  identify possible candidates for maximum product.

$\Rightarrow$  identify possible candidates for minimum product

calculating maximum product:

\* The two longest positive numbers are  $10 \times 11 = 110$

\* The two smallest negative numbers are  $-9$  and  $-8 = 72$

The maximum product is 0

calculating minimum product:

\* The largest positive and negative numbers  $11$  and  $-9$   $11 \times -9 = -99$

\* The smallest positive and negative numbers are  $-9 \times 8 = -72$

$-99$  is smaller than  $72$

Maximum product = 110, and minimum product = -99

② Demonstrate the binary search method to search for the key = 23 from the

array = {2, 5, 8, 12, 16, 23, 38, 56, 72, 91}

③ Initialize pointers

low = 0 and high = 9

calculate  $mid = \left\lfloor \frac{low + high}{2} \right\rfloor = \frac{0 + 9}{2} = 4$

compare  $arr[mid]$  with key :

$arr[4] = 16$

since  $16 < 23$  update  $low = mid + 1 = 5$

calculate  $mid = \left\lfloor \frac{low + high}{2} \right\rfloor = \frac{5 + 9}{2} = 7$

compare  $arr[mid]$  with key

$arr[7] = 56$

since  $56 > 23$  update  $high = mid - 1 = 6$

$mid = \left\lfloor \frac{5 + 6}{2} \right\rfloor = 5$

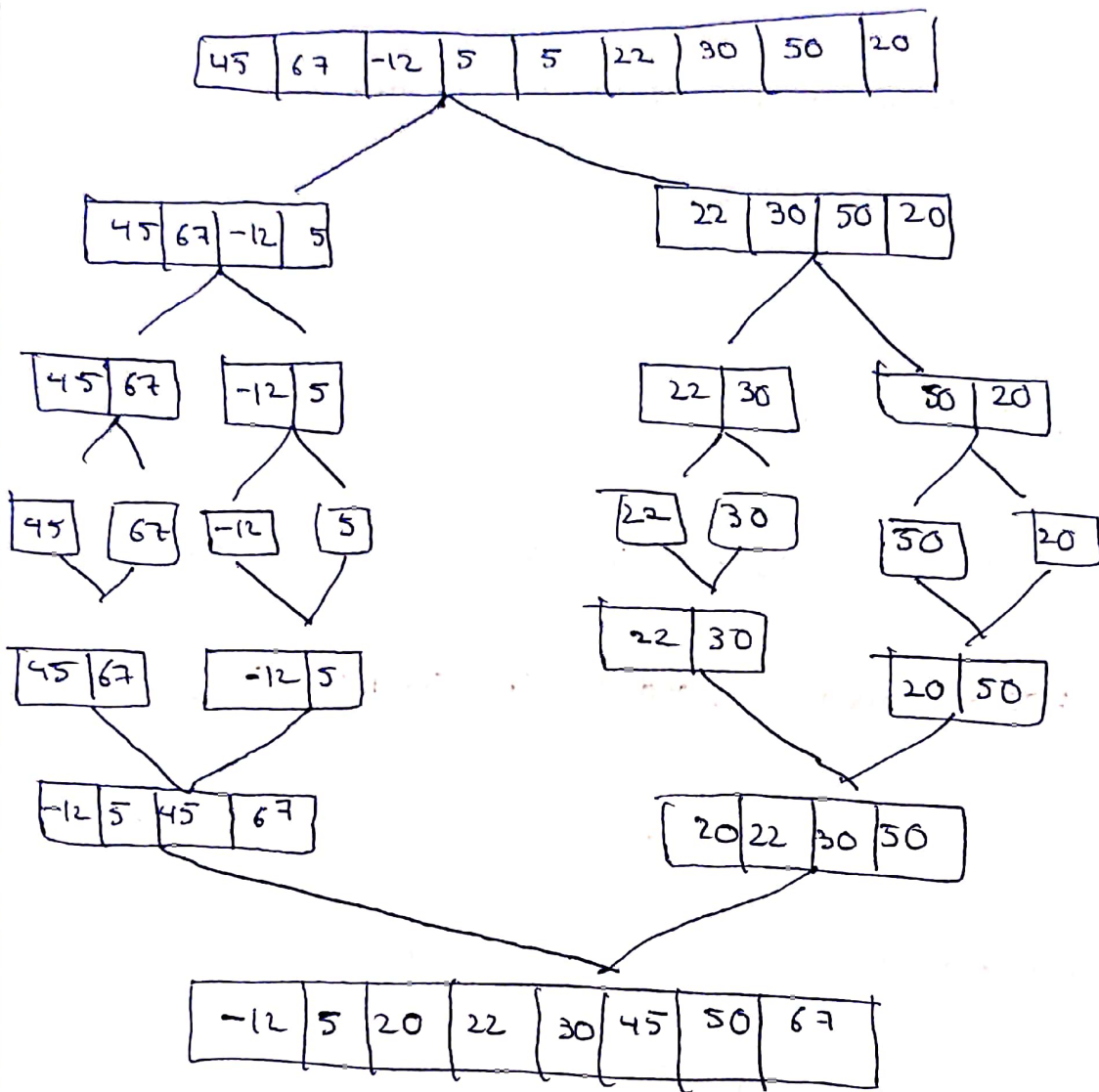
$arr[mid] = arr[5] = 23$

$23 == 23$   $\therefore$  the key found

④ Apply merge sort and other list of 8 elements, Data d = {45, 67, -12, 5, 22, 30, 50, 40}

set up a recursive relation for the number of key comparisons made by merge sort.

⑤ Merge sort



∴ The sorted list = (-12, 5, 20, 22, 30, 45, 50, 67)

- ⑥ Find the no. of times to perform solving swapping for selection sort also estimate the time complexity for the array of notation set
- S(12, 7, 5, -2, 18, 6, 13, 4)

- ⑤ The selection sort algorithm always makes exactly  $n-1$  swaps in the worst case, where  $n$  is the no. of element in the list

given  $s = \{12, 7, 5, -2, 18, 16, 13, 4\}$

$$n = 8$$

$$\text{no. of swaps } n = 8, n = n - 1 = 7$$

so, the time complexity of selection sort in Big-O notation is  $O(n^2)$ .

so, the numbers of swaps is 7, and the time complexity is  $O(n^2)$

- ⑤ Find the index of the target value 10 using binary search from the following list of elements  $\{2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$

- ⑤ Given list =  $\{2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$  and

$$\text{value} = 10$$

$$\text{low} = 0 \text{ and } \text{high} = 9$$

$$\text{mid} = \frac{\text{low} + \text{high}}{2} = \frac{0 + 9}{2} = 4$$

$$\text{Ex: list(4). mid} = 10, \text{ mid} = \text{value}$$

since  $10 == 10$  the target is found at index 4

$\therefore$  The Target value = 10 is found at index 4