ASSIGNMENT-12

Challa. Raviteja
192325065 (CSA0670)

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.

A: array is {4, -2, 5, 3, 10, -5, 2, 8, -3, 6, 7, -4, 1, 9, -1, 0, -6, -8, 11, -9}
we need to consider the largest and smallest product that we can be formed by selecting two numbers from the array

1. Sort the array.
   Sorted array: [-9, -8, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
2. Identify possible candidates for maximum product.
3. Identify possible candidates for minimum product.

Calculating maximum product

* The two largest positive numbers are 10 and 11

$$10 \times 11 = 110$$

* The two smalest negative numbers are -9 and -8

$$-9 \times -8 = 72.$$

The maximum product is 110.

Calculating minimum product

* The largest positive and negative number is 11 and -9

$$11 \times -9 = -99.$$

The smallest negative numbers are $-9 \times -8 = 72$.

-99 is smaller than 72 so,

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}

A: Given Key = 23 and array = {2,5,8,12,16,23,38,56,72,91}

1. Initialize pointers

low = 0 and high = 9.

Calculate $mid = \left[\frac{low + high}{2}\right]$

$Mid = \left[\frac{0+9}{2}\right]$

Mid = 4.

Compare arr[mid] with key:

arr[4] = 16

Since 16 < 23 update low = mid + 1 = 5

Calculate $mid = \left[\frac{low + high}{2}\right]$

$Mid = \left[\frac{5+9}{2}\right]$

Mid = 7

Compare arr[Mid] with key.

arr[7] = 56.

Since 56 > 23 update high = mid - 1 = 6.

$mid = \left[\frac{5+6}{2}\right] = 5$.

arr[Mid] = arr[5] = 23

23 = 23.

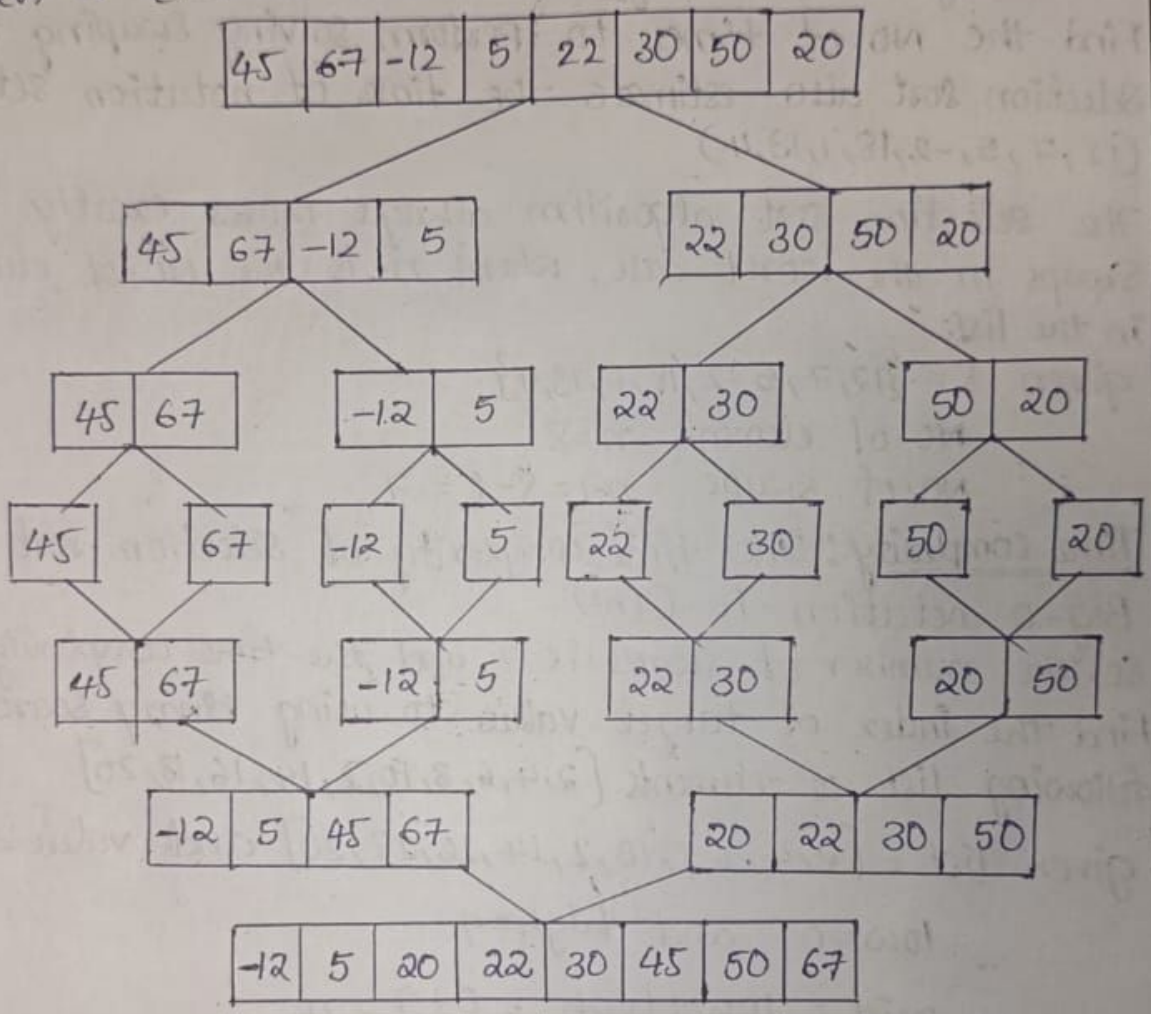
The key is found at index 5.

∴ The key = 23 is found at index 5.

3. Apply merge sort and other list of 8 elements, data d= [45, 67, 12, 5, 22, 30, 50, 70]. Set up a recurrate relation for the number of key comparisons made by merge sort.

A: Merge sort:

given d = [45, 67, -12, 5, 22, 30, 50, 20]



∴ The sorted list = [-12, 5, 20, 22, 30, 45, 50, 67]

4. Find the no. of times to perform swapping for selection sort also estimate the time

Recursive relation for comparision.

A: $T(n) = 2 + (n/2) + O(n)$ if $n = 1$, $T(n) = 0$

At each level of recursive we move at most n-1 comparison to merge two levels of six N so it becomes.

$T(n) = 2 + (n/2) + (n-1)$

Solving reccurence relation we get

$T(n) = n\log_2(n) - n + 1$

$\therefore T(n) = O(n \log n)$

The recurence relation is $T(n) = 25(n/2)$ to (n) or more precisely. $T(n) = n\log_2(n) - n + 1$

(ii) Find the NO. of times to perform solving swaping for Selection sort also estimate the time of notation set S (12, 7, 5, -2, 18, 1, 13, 4)

A: The selection sort algorithm always moves excatly $n-1$ Swaps in the worst case, where n is the NO. of elements in the list.

given $S = \{12, 7, 5, -2, 18, 6, 13, 4\}$

NO. of elements $n = 8$

NO. of swaps $= n-1 = 8-1 = 7$

Time complexity: The time complexity of selection sort is Big-O notation is $O(n^2)$

So, The number of swaps is 7 and the time complexity $O(n^2)$

5. Find the index of target value to using binary search for following list of elements [2, 4, 6, 8, 10, 2, 14, 16, 18, 20]

A: given list = [2, 4, 6, 8, 10, 2, 14, 16, 18, 20] and value = 10

low = 0 and high = 9.

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

mid = 10 mid = = value.

Since 10 = = 10 The target is found at index 4

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