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. Array is [4,-2,5,3,10,-5,2,8,-3,6,7,-4,1,9,-1,0,-6,-8,11,4]
we need to consider the largest and smallest products that 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 produd.

Caluclating maximum product:

* The two largest positive numbers are 10 and 11 = 10×11 = 110
* The two smallest negative numbers are -9 and -8 = 72

The maximum product is 110.

caluclating minimum products

The largest positive and negative numbers is 11,-9 = -99
The smallest positive and negative numbers -9x-8 = 72.

Demonstrate the primary search methad to search for the key = 23 from the array = {2,5,8,12,16,23,38,56,72,91}

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

* Initialise pointers

low = 0 and high = 9

calculate mid = $\left(\frac{\text{low+high}}{2}\right) = \left(\frac{0+4}{2}\right) = 4$

compare arr(mid) with key:

arr(4) = 16

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

Calculate mid = $\left(\frac{\text{low+high}}{2}\right) = \left(\frac{5+9}{2}\right) = 7$

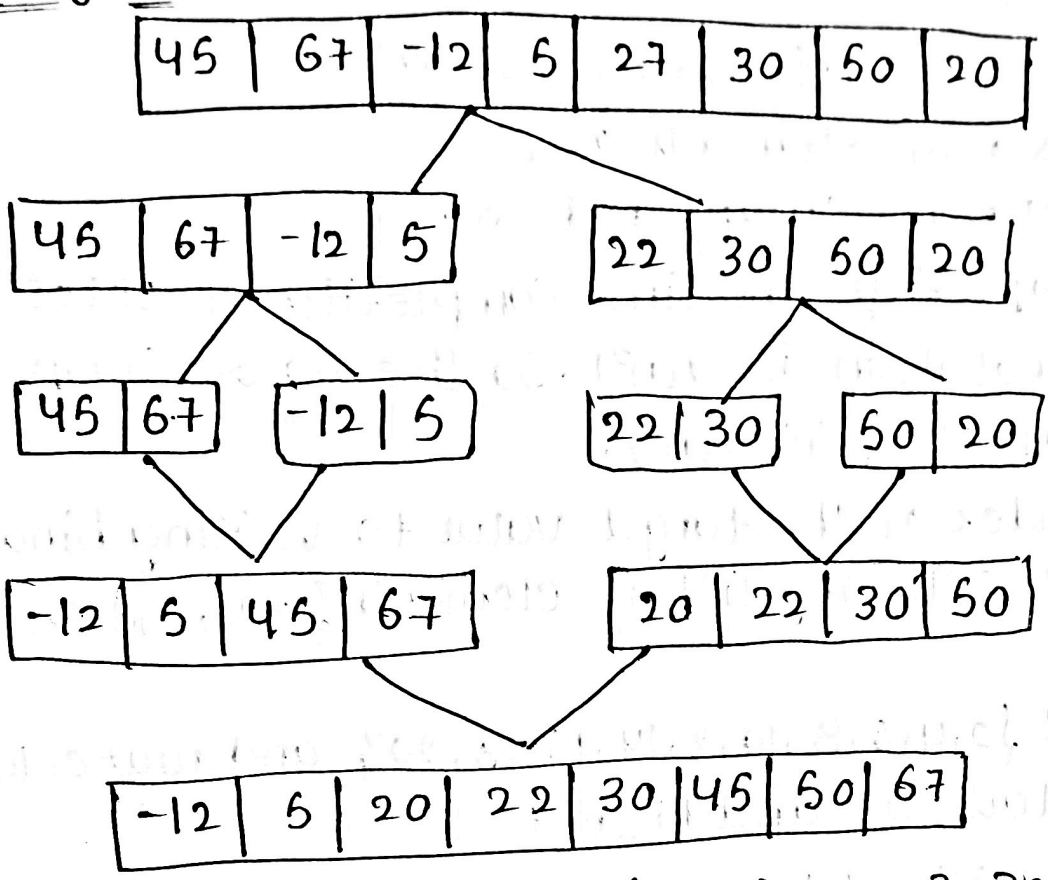
arr[7] = 56 56 > 23 update high = mid-1 = 6

mid = $\left(\frac{5+6}{2}\right) = 5 \Rightarrow$ arra[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, 20) . Set up a recurrence relation for the no of key comparisons made by mergesort

Sol. Merge Sort :-



∴ The sorted list = (-12, 5, 20, 23, 30, 45, 50, 67)

$$T(n) = 2T(n/2) + O(n)$$

if $n = 1$, $T(1) = 0$, Best case

→ At each level of recursion we make at most in 1 comparison merge two halves of size n/2 so it becomes

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

Solving recurrence relation we get

$$T(n) = n \log 2(n) - (n+1)$$

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

$$T(n) = n \log 2(n) - n + 1$$

4. Find the no. of times to perform solving swapping for Solution Sort also estimate the time complexity for other of notations Sets (12,7,5,-2,18,6,13,7)

Sol. The Selection Sort algorithm always makes exactly n-1 swaps in the worst case, where n is the no of elem in the list.

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

No of elements, $n = 8$

No of swaps $n-1 = 8-1 = 7$

Time complexity: The time complexity of selectionsort in Big O notation is $O(n^2)$. So the no of swap and time complexity is $O(n^2)$.

5. Find the index of the target value to visiting binary sea team the following list of elements $\{2, 4, 6, 8, 10, 12, 14, 1$ 20$\}$.

Sol. given: list $\{2, 4, 6, 8, 10, 2, 14, 16, 18, 20\}$ and route=10

low = 0, and high=9

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

mid = 10, mid == value

Since == 10 the target is found at index 4

∴ The target value = 10 is formed an index