1. Given an array of [4,-2,5,3,10,-5,2,8,-3,6,7,-4,1,9,-1,0,-6,-8,11,-4] 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 Product

Calculating maximum Product

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

The maximum Product is 110
calculating minimum Products
The largest positive and negative numbers is 11 and -9
11 x -9 = -99
The smallest negative numbers are -9 x -8 = +72, -99 is smalle than +72 so maximum Product = 110, and minimum Product = -99

2. Demonstrate the Primary search method to search for the key = 23 from the array = {2,15,8,12,16,23,38,56,72,91}

Sol: Given key = 23 & array = {2,15,8,12,16,23,38,56,72,91}

* Initialise pointers

low = 0 and high = 9

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

compare arr(mid) with key:

arr(4) = 16

since 16 < 23 update Low = mid + 1 = 5

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

compare arr(mid) with key:

arr[7] = 56

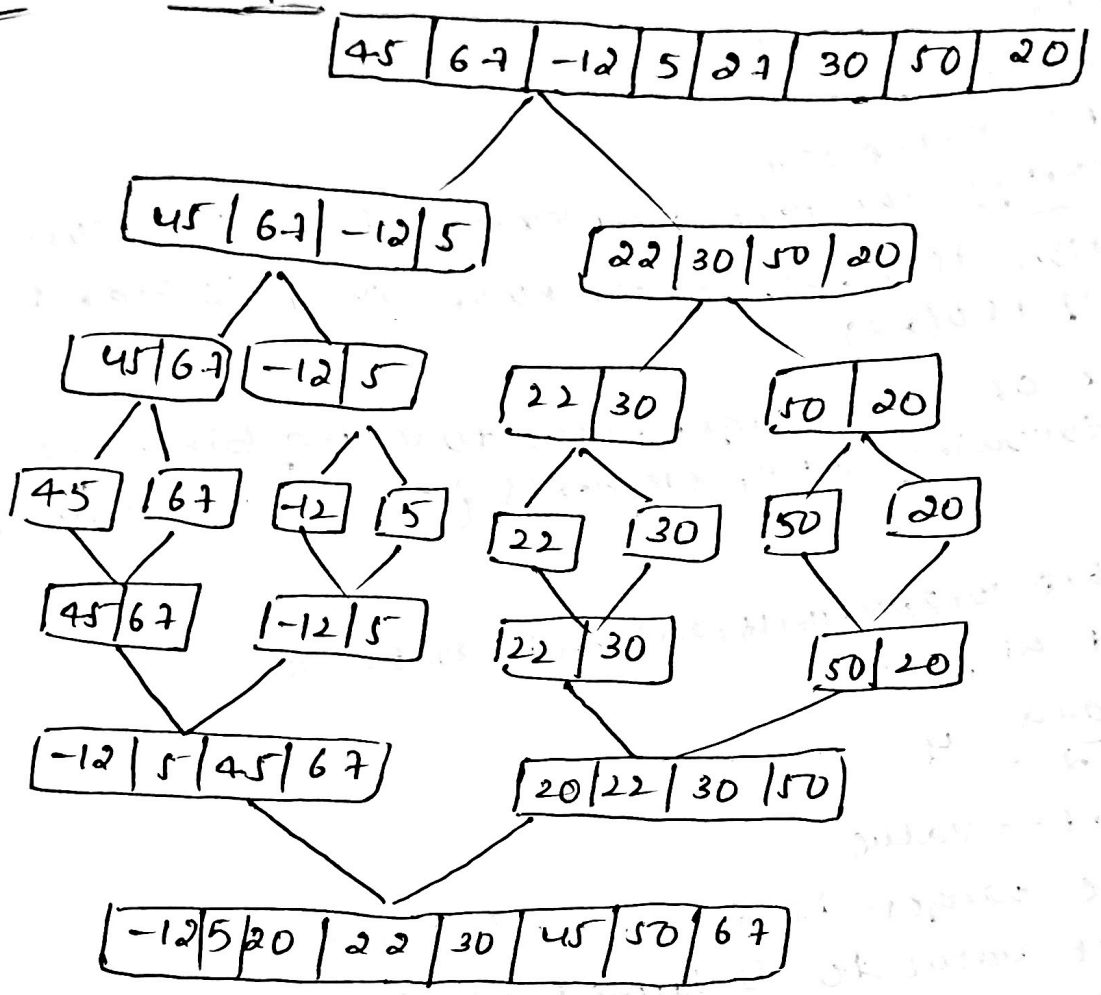
since 56 > 23 update high = mid - 1 = 6

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 i 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: Mergesort:



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

4) Find recurrence relation for comparisons

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

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

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

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

Solving recurrance relation we get

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

∴ $T(n) = O(n \log n)$

∴ The recurrance relation is $T(n) = 2T(n/2) + O(n)$ or more Precisely $T(n) = n \log_2(n) - n + 1$

4. Find the no. of times to perform solving swapping for solution sort also estimate the time complexity for others of notations sets (12,7,5,-2, 16,6,13,4)

Sol: The selectionsort algorithm always makes exactly n-1 swaps in the worst case, where n is the no. of elements in the list.

S = {12,7,5,-2,16,6,13,4}:

No. of elements, n=8

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

Time complexity: The time complexity of selection sort in Big O. notation is O(n2). So, the no. of swap is 7 and time complexity is O(n2)

5. Find the index of the target value to using binary search team the following list of elements {2,4,6,8,10,12,14,16,18,20}

given: list {2,4,6,8,10,12,14,16,18,20} and route = 10

low = 0, and high = 9

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

mid = 10, mid == value

since == 10 the target is found at index 4

∴ The target value 10 is formed an index 4.