Some Problems asked in interview :

Problem 1 :

input : An array of n elements in which until some place all values are integers and after that all values are infinite

output : Find the position of first infinite element.

Solution :

0	1	2	3	4	5	6	7	8
2	4	5	1	-1	*	*	*	*

Position = 5

mid = (0 + 8)/2 = 4

BinarySearch(i,j)

a[mid] == *

return mid

a[mid] != *

BinarySearch(mid+1,j)

Linear Search = O(n)

BinarySearch algorithm = O(logn)

Note :

If in any problem you are able to decide whether to go to left or right just like in binary search implementation, then you can say that we can apply the binary search like implementation in that particular problem. It doesn't matter in that particular case that whether your array is sorted or not.

Problem 2 :

input : An array of n elements in which until some place all are integers and afterwards all are infinite. And here you have to assume that n is unknown and after completion of array all are $

output : Find the position of first infinite

Solution :

Linear Search = O(n)

BinarySearch algorithm = O(logn)

Problem 3 : This problem is given to you for your self evaluation

$$T(n) = \begin{cases} 1 & \text{if } n = 0 \\ T(n-2) + n^2 & \text{if } n > 0 \end{cases}$$

$$\begin{aligned} T(n) &= T(n-2) + n^2 \\ &= T(n-4) + (n-2)^2 + n^2 \\ &= T(n-6) + (n-4)^2 + (n-2)^2 + n^2 \text{ -> upto k times where } k = n/2 \end{aligned}$$

$n - 2k = 0$

$n = 2k$

$n/2 = k$

$$\begin{aligned} &= T(n-2k) + (n-2k+2)^2 + (n-2k+4)^2 + \dots\dots\dots + (n-2)^2 + n^2 \\ &= T(n-2(n/2)) + (n-2(n/2)+2)^2 + \dots\dots\dots + (n-2)^2 + n^2 \\ &= T(0) + (2)^2 + (4)^2 + (6)^2 + \dots\dots\dots + (n-2)^2 + n^2 \\ &= 1 + (2)^2 + (4)^2 + (6)^2 + \dots\dots\dots + (n-2)^2 + n^2 \end{aligned}$$

= $1 + 2^2 ((1)^2 + (2)^2 + (3)^2 + \ldots\ldots\ldots\ldots\ldots\ldots + (n/2)^2)$

Sum of squares of n natural numbers = $(n (n+1) (2n+1))/6$

Sum of squares of n/2 natural numbers = $(n/2 (n/2+1) (2(n/2)+1))/6$

= $1 + 2^2((n/2 (n/2+1) (2(n/2)+1))/6)$

= $O(n^3)$

Problem 4 : Arrange in increasing order -

1. $n^2 + n$

2. $\log^2 n$

3. $n/\log n$

4. $5n + 4$

5. $\log \log n$

6. $\mathrm{sqrt}(n)$

7. 2^n

8. $(\log n)^{\log n}$

$f5 < f2 < f6 < f3 < f4 < f1 < f8 < f7$