Case-study 4

Q) Finding a number in an array

A = [3, 6, 1, 33, 8, 5, 11, 23, 0]

B = [0, 1, 3, 5, 6, 8, 11, 23, 33, 88]

Solution:

A = [3, 6, 1, 33, 8, 5, 11, 23, 0]

A is unsorted

let X = 23 ∴ N is number of elements in list/array

if (X < A[0] or X > A[N-1])

print → X is not present in the list

for i : 0 → (N-1)

if (A[i] == X)

print → X is present

return;

else

print → X is not present

return;

Best case:

Best case is when X is present at the index 0.

$\Omega(\cdot) = 1$

Worst case:

Worst case is when we have to check till the last index of array i.e N-1

$$O(\cdot) = N$$

Solution:

B = [0, 1, 3, 5, 8, 11, 23, 33, 88]

```
if (X < B[0] or X > B[N-1])
    print -> X is not present
for (i=0 ; i<N ; i++)
    if (B[i] == X)
        print -> X is present return;
    else if (B[i] > X)
        print -> X is not present
            return;
```

In this case, the loop will stop when B[i] is greater than X, because the list is sorted, and no need to check when B[i] > X.

Best case:

Best case is when we have ~~to~~ find the X at zero index

$$\Omega(\cdot) = 1$$

Worst case:

Worst case is when we have to find the X till the last index

$$O(\cdot) = N$$

Solution:

$B = [0, 1, 3, 5, 6, 8, 11, 23, 33, 88]$

sorted list

Using Binary Search: $N \rightarrow \frac{N}{2} \rightarrow \frac{N}{4} \rightarrow \frac{N}{8} \ldots$

Let $X = 10$

$B = [0, 1, 3, 5, 6, 8, 11, 23, 33, 88]$

$mid = 6$

$B_1 = [0, 1, 3, 5, 6]$

$B_2 = [8, 11, 23, 33, 88]$

$X > mid$

$10 > 6$

remove B_1 as X is greater than the all elements in B_1.

$B_2 = [8, 11, 23, 33, 88]$

$mid = 23$

$B_3 = [8, 11, 23]$

$B_4 = [33, 88]$

$X < mid$

$10 < 23$

remove B_4 as X is lesser than all elements in B_4.

$B_3 = [8, 11, 23]$

$mid = 11$

$B_5 = [8]$

$B_6 = [11, 23]$

$10 < 11$

$X < mid$

remove B_6.

$B_5 = [8]$

X is not present in the list