

CO1 1. Verify whether $12 \log(\log n) + 15n + 30 = O(n)$ [If true find out c and n_0 , if false state the reason. Here O indicates upper bound] 06

CO3 2. Find out the Time Complexity of the following code snippets. You have to mention the complexity of each loop then you have to find the total complexity. 06

```
Sum=0;
① for(i = n; i >= 1; i = i/7){  $\rightarrow O(\log_7 n)$ 
  ② for(j = 1; j <= n; j = j + 5){  $\rightarrow O(n/5) \approx O(n)$ 
    Sum++;
  }
  ③ for(p = 1; p < 45; p++){  $\rightarrow O(1)$ 
    Sum++;
  }
}
```

CO4 3. For a sorted list of 6561 elements, calculate how many steps ternary search might take at most? 03

$$12 \log(\log n) + 15n + 30 = O(n)$$

• n is the upper bound of $12 \log(\log n) + 15n + 30$

• True

• For upper bound,

$$f(n) \leq c g(n)$$

$$12 \log(\log n) + 15n + 30 \leq cn$$

~~if $c = 57$ and $n = 1$,~~

$$12 \log(\log(1)) + 15(1) + 30 \leq 57(1)$$

$$\Rightarrow \downarrow \text{math error} + 15 + 30 \leq 57 \text{ or } 57 \quad \times$$

$$12 \log(\log(2)) + 15(2) + 30 \leq 57(2)$$

$$\Rightarrow 53.74 \leq 114 \quad \checkmark$$

$$c = 57, n_0 = 1 \quad \times$$

$$n_0 = 2$$

Ans! $c = 57, n_0 = 2$

2) For loop 1, $O(\log_2 n)$

For loop 2, $O(n)$

For loop 3, $O(1)$

Now, loop 2 and 3 are nested inside loop 1.

$$O(\log_2 n) [O(n) + O(1)]$$

$$\Rightarrow O(n \log_2 n) + O(\log_2 n)$$

$$\Rightarrow O(n \log_2 n)$$

(Ans.)

max of the two
should be considered

3) Time complexity of Ternary search = $O(\log_3 n)$

no. of elements = 6561

$$\log_3 n = 6561$$

$$\Rightarrow \log_3 n = 3^8$$

$$n = 6561$$

$$\Rightarrow \log_3 n = \log_3 6561$$

$$\Rightarrow \log_3 n = \log_3 3^8$$

$$\Rightarrow \log_3 n = 8 \log_3 3$$

$$\Rightarrow \log_3 n = 8$$

\therefore 8 steps at most might be needed.
(Ans.)

CO1 1. Verify whether $12n (\log n)^3 + 15n + 30 = O(n^2)$ [If true find out c and no, if false state the reason. Here O indicates upper bound] 06

CO3 2. Find out the Time Complexity of the following code snippets. You have to mention the complexity of each loop then you have to find the total complexity. 06

```
Sum=0;
for (i=n; i>=1; i=i/3) {  $O(\log_3 n)$ 
  for(j=1; j<=n; j=j*9) {  $O(\log_9 n)$ 
    Sum++;
  }
  for(p=1; p<45; p++) {  $O(44)$ 
    Sum++;
  }
}
```

CO4 3. For a sorted list of 1024 elements, calculate how many steps binary search might take at most? 03

2no Ans

$$\begin{aligned}
 & O(\log_3 n) \times (O(\log_9 n) + O(44)) \\
 \Rightarrow & O(\log_3 n) \times (O(\log_9 n) + O(1)) \\
 \Rightarrow & O(\log_3 n) \times O(\max(\log_9 n, 44)) \\
 \Rightarrow & O(\log_3 n) \times O(\log_9 n) \\
 \Rightarrow & O(\log_3 n \cdot \log_9 n)
 \end{aligned}$$

3no Ans

Q.

For binary search,

$k = \log_2 n$ where $n = \text{number of elements}$

$$k = \log_2 (1024)$$

$$\Rightarrow k = 10$$

1 no Ans

$$12n(\log n)^3 + 15n + 30 = O(n^2)$$

• n^2 is upper bound of $12n(\log n)^3 + 15n + 30$

* True

$$12n(\log n)^3 + 15n + 30 \leq c_1 n^2$$

$$\therefore c_1 = 57, n_0 = 1$$

e for,

$$c_1 = 57$$

$$n_0 = 1$$

statement true