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Tutorial - 1

Ans-1 Asmptotic notation discribe the algorithim effiong and Perfomance in a meaningful way. it describe the behaviour of time or Space Complexity for large instanc chracteristics. They are mathematical tool to represent the time Complexity of algorithim for asypototic analysis.
There are mainly threee asymptotic notations

1 **Big-O Notation**

The Big O notation defines an upper bound of an algorithim, it bounds a function only from above. for ex- insertion Sort. It takes linear time in best case & quadratic time in worst case is O(n²)
So we can say that TC of insertion Sort is O(n²).

$$f(n) = O g(n)$$

g(n) is tight upper bound of f(n)

$$f(n) = O(g(n))$$

$$\text{if } f(n) < C.g(n)$$

$$\forall\ n \geq n_0, \text{ Some Constant } C > 0$$

2 **Omega notation (Ω-notation)**

Omega notation represent the lower bound of the running time of an algorithim. It can be usefull when we have lower bound on time complexity. of an algorithim.

Ex → The time complexity of insertion Sort can be written as Ω(n), but is not a very usefull information about insertion.

3 **Theta notation (Θ notation)**

The Theta notation bounds a function from abow and below So it define exact asyptotic behaviour

Ex $3n^3 + 6n^2 + 6000 = \Theta(n^3)$

Ans-2 $O(\log n)$

Ans-3 $T(n) = 3T(n-1)$ if $n>0$ otherwise 1

$= 3(3T(n-2))$

$= 3^2 T(n-2)$

$= 3^3 T(n-3)$

$= 3^n T(n-n)$

$T(n) = \underline{3^n}$

Ans-4 $T(n) = 2T(n-1) - 1$ if $n>0$ othewise 1

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

$= 2^2(T(n-2)) - 2 - 1$

$= 2^3(T(n-3)) - 2^2 - 2^1 - 2^0$

$= 2^n(T(n-n)) - 2^{n-1} - 2^{n-2} \ldots - 2^0$

$\underline{T(0) = 1}$

$= 2^n - (2^n - 1)$

$\underline{TC} = O(2^n)$

Ans-5 $TC = O(\sqrt{n})$

Ans-6 $TC = O(\sqrt{n})$

Ans-7 $TC = n/2 \times \log n \times \log n$

$= O(n \log^2 n)$

Ans-8 $TC = O(n^3)$

Ans-9

i =	j
1	n times
2	n/2 times
3	n/3 times
n	n/n times

TC $\in O(n \log n)$

Ans-10 Since Polynomial grow Smaller than exponentional n^k has an asmyptotic upper baund of $O(a^n)$.

for $a=2$, $n_0=2$