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1. $TC = O(n^2)$

↳ It takes 5 sec for $n=10$

Lets say $Kn^2 = 5$

$K \cdot 100 = 5$

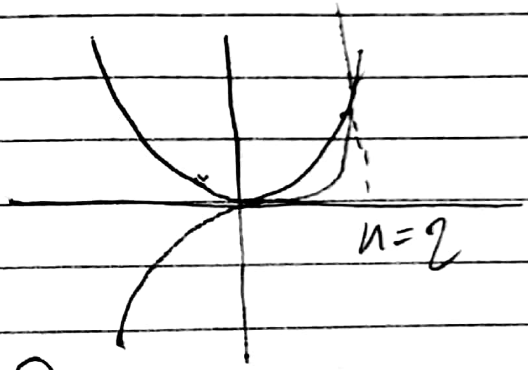
$K = 5/100$

For $n = 50$

Time $= K(50)^2 = 125$ seconds

2. $T(A_n) = n^3$

$T(B_n) = 2n^2$




So $n^3 = 2n^2$

$n^2(n-2) = 0$

$n = 2$ ($n=0$ not possible)

After $n=2$, they will deviate.

3. Using limit rule to check that $n2^n$ is in $O(4^n)$

$$\lim_{n\to\infty} \frac{4^n}{n2^n} = \lim_{n\to\infty} \frac{2^n}{n} \Rightarrow \lim_{n\to\infty} \frac{n2^{n-1}}{n} = \infty$$

∴ It means for large values of $n$, $4^n$ is much greater than $n2^n$.

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4. The slope of the graph of log function is very less compared to the functions ~~other~~

$\therefore$ We can say log has slowest growth rate compared to other polynomial function

5. $\Theta$ and $O$ and $\Omega$

$\Theta \Rightarrow$ Average case time complexity i.e, it is the average of the time complexity that a function/algorithm performs.

$O \Rightarrow$ It is the worst time or worst performance a ~~and~~ function/algorithm takes.

$\Omega \Rightarrow$ It is best case for an function or algorithm.

6(a) $n^4 + \log n + 17$

$$\lim_{n\to\infty} n^4 + \log n + 17 = \lim_{n\to\infty} n^4\left(1 + \frac{\log n}{n^4} + \frac{17}{n^4}\right)$$

$$= \lim_{n\to\infty} n^4$$

We can say worst complexity for the given function is same as for $n^4$

$\therefore O(n^4)$.

7 (a)

K = 1
while K ≤ n
    K = K+1
End while

⇒ $O(n)$

(b) for i = 1 to n-1
    for j = i+1 to n
        Swap

No. of times loop executes ⇒ $\frac{n^2 - n}{2}$

Complexity = $O(n^2)$.

8. Algorith time complexity = $O(n^2)$

For $kn$ inputs $= k^2 n^2$
$2n$ $= 4n^2$

for $k = \sqrt{2}$
If input size increase by $1.42$ times then that the time for running algorithm will become twice.

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9. $T_A = 100^n$
$T_B = n^4$

$$\lim_{n\to\infty} \frac{100^n}{n^4} \Rightarrow \frac{100^n \log 100}{4n^3} = \infty$$

$$\cancel{\lim_{n\to\infty} \left(100^n \log 100\right)}$$

Since $T_A / T_B = \infty$,
$\therefore$ $T_A$ is worst in terms of performance to $T_B$

11(a) $2^{n-1} + 4^{n+1}$

$$\frac{2^n}{2} + 2^{2n+2}$$

$$2^n\left(\frac{1}{2} + 2^n \cdot 4\right)$$

Avg case $\Rightarrow$ $2^n$ or $4^n$

Worst case $\Rightarrow$ $4^{n+1}$

(b) Worst case for $(n^2+6)^8$
By binomial expansion term with high power is $n^{16}$. This term will affect the function largely for large values of $n$

$\therefore O(n^{16})$.

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12. $T_1 = n^2$

$T_2 = n + 2$

Break point $\Rightarrow n^2 = n + 2$

$= n^2 - n - 2$

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

$\underline{\underline{n = 2}}$

After $n = 2$, $n^2$ grows faster than $n+2$.