Note about Master Theorem...

Even our advanced Master Theorem does not have all the answers for all Divide & Conquer recurrence relations.

Consider $T(n) = 2T(n/2) + \underbrace{n \lg n}_{f(n)}$ $\quad \log_2 2 = 1$

$n \lg n \stackrel{?}{\in}$

$O(n^{1-\varepsilon})$ for some +ve ε

$\Theta(n)$ i.e. $\lg n \in \Theta(1)$

$\Omega(n^{1+\varepsilon})$ for some ε

$O(n^{-\varepsilon})$

$\Omega(n^{\varepsilon})$

$n \lg n$ is not in any of these categories

We can see that more clearly if we divide $n \lg n$ and whats in the O, Θ, Ω by n (yes, we can do that)

Then the question becomes:

$\lg n \stackrel{?}{\in}$

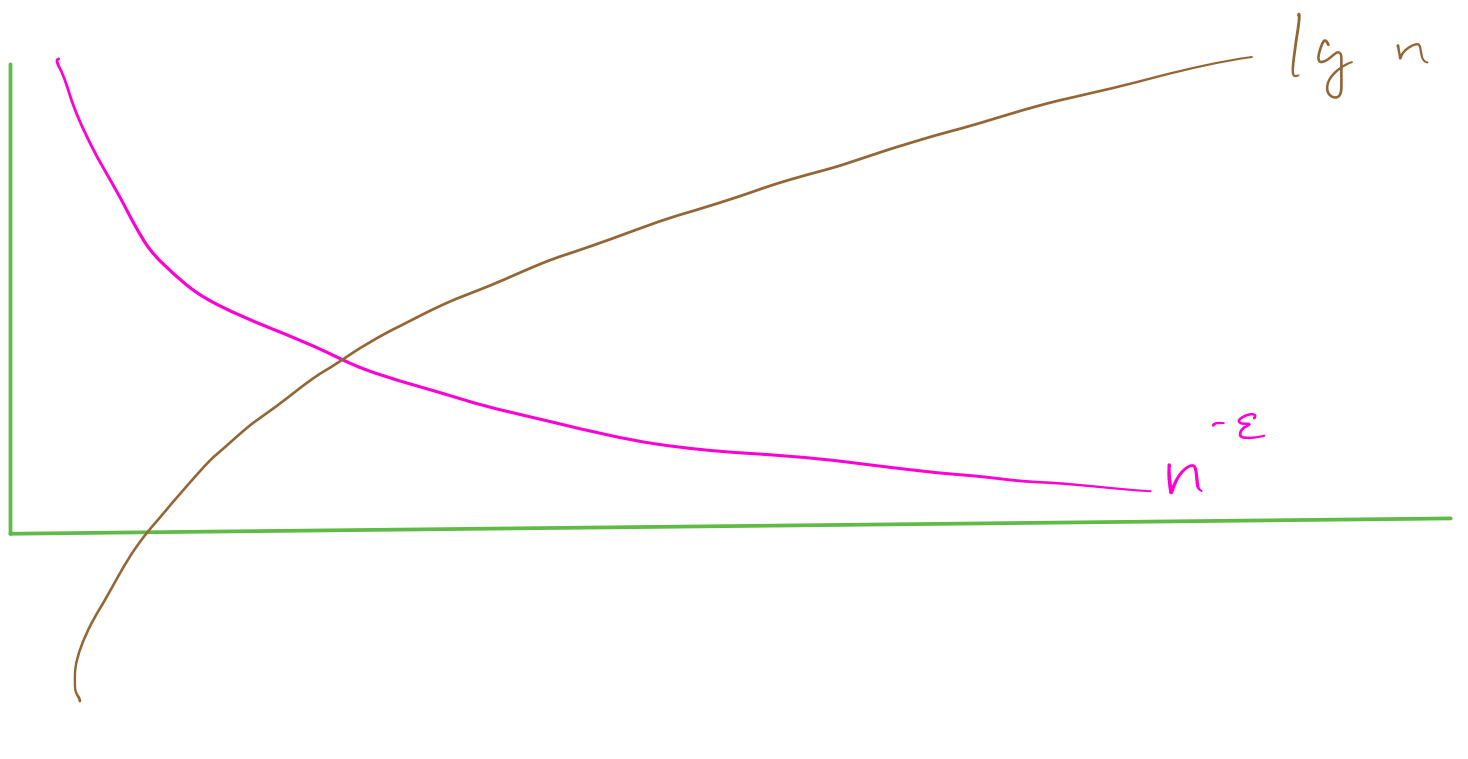
$O(n^{-\varepsilon})$ for positive ε

$\Theta(1)$

$\Omega(n^{\varepsilon})$

} we know $\lg n$ is not in these classes.

$n^{-\varepsilon}$ is actually a decreasing function,
whereas $\lg n$ is an increasing function,
so clearly $\lg n \notin O(n^{-\varepsilon})$ for any positive ε.



∴ The master Theorem is SILENT on this recurrence.

That's the answer you give on a test or assignment.