$\boldsymbol{Conditional\ Asymptotics -}$
$\boldsymbol{Example}$

$\boldsymbol{Example: Let\ T(n)\ be\ a\ conditional\ asymptotic}$
$\boldsymbol{T(n) \in \{\Theta(log_2 n |\ n\ is\ a\ power\ of\ 2)\}.}$
$\boldsymbol{Apply\ smoothness\ rule.}$

$\boldsymbol{Solution: Check\ whether\ T(n) is\ an\ eventually}$
$\boldsymbol{non - decreasing\ function. The\ function\ log_2 n\ is\ an}$
$\boldsymbol{eventually\ decreasing\ function.}$

$\boldsymbol{However\ , is\ it\ a\ smooth\ function?}$

$\boldsymbol{Let\ us\ verify\ this\ now.}$

$\boldsymbol{It\ is\ clear\ that\ logn \in \Theta(logn). Therefore, check}$
$\boldsymbol{whether\ this\ condition\ holds\ good\ for\ a\ value}$
$\boldsymbol{of\ b = 2. It\ can\ be\ shown\ as\ a\ smooth\ function\ as}$
$\boldsymbol{follows:}$

$\boldsymbol{log2n = log_2 2 + log_2 n}$
$\boldsymbol{= 1 + log_2 n}$
$\boldsymbol{\in O(logn)}$

$\therefore T(n) \in O(logn)$ *for all values of* n.

It is established that $\log n$ *is a smooth function. Therefore, the recurrence equation is applicable for all values of* n.

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