Master's Theorm.

$T(n) = aT(n/b) + c * n^d$.

1) $T(n) = 8T(n/2) + 1000n^2$

$a=8$ $b=2$ $c=1000$ $d=2$.

$b^d = 4$ $a > b^d$

$T(n) \leftarrow n^{\log_2 a}$

$T(n) \leftarrow n^{\log_2 8}$ $T(n) \leftarrow n^3$

2) $T(n) = 2T(n/2) + n^2$

$T(n)$

$a = 2$ $b=2$, $d=2$.

$a < b^d$

$2 < 4$.

$T(n) \in n^d$.

$T(n) \in n^2$

3) $T(n) = 2T(n/2) + 10n$

$a=2$, $b=2$, $d=1$.

$a = b^d$.

$T(n) = n^d \log n = n \log n$

Masters' theorm:-

If $f(n) \in (n^d)$ or $f(n) = c * n^d$ where $d \geq 0$ in reccurrence.

$T(n) = aT(n/b) + f(n)$ then

$$T(n) \in \begin{cases} O(n^d), & \text{if } (a < b^d) \\ O(n^d \log n), & \text{if } (a = b^d) \\ O(n^{\log_b a}), & \text{if } (a > b^d). \end{cases}$$

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$b^d = 4 \qquad a > b^d$

$T(n) \leftarrow n^{\log_2 a}$

$T(n) \leftarrow \cancel{\log}\ n^{\log_2 8} \qquad T(n) \leftarrow n^3$

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