CSCE 3110.002 // ASSIGNMENT 2

KULTHUM LAKHA // kyl0029

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$$T(n) = aT\left(\frac{n}{b}\right) + f(n)$$

- $T(n) = 2T\left(\frac{n}{4}\right) + 1$

$a=2$, $b=4$, $f(n)=1$

$n^{\log_4 2}$ vs. $1$

$n^{\frac{1}{2}}$ vs. $1$

case 1: $f(n) = O(n^{\frac{1}{2}-\varepsilon})$  $\varepsilon = \frac{1}{2}$

$$\therefore \underline{T(n) = \Theta(n^{\frac{1}{2}})}$$

- $T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$

$a=2$, $b=4$, $f(n)=\sqrt{n}$

$n^{\log_4 2}$ vs. $\sqrt{n}$

$n^{\frac{1}{2}}$ vs. $n^{\frac{1}{2}}$

case 2: $f(n) = \Theta(n^{\frac{1}{2}} (\log n)^0)$

$$\therefore \underline{T(n) = \Theta(n^{\frac{1}{2}} \log n) = \Theta(\sqrt{n} \log n)}$$

- $T(n) = 2T\left(\frac{n}{4}\right) + n$

$a=2$, $b=4$, $f(n)=n$

$n^{\log_4 2}$ vs. $n$

$n^{\frac{1}{2}}$ vs. $n$

$\frac{1}{2} + \varepsilon \geq 1$

case 3: $f(n) = \Omega(n^{\frac{1}{2}+\varepsilon})$  $\varepsilon = \frac{1}{2}$  $\varepsilon \geq \frac{1}{2}$

and

$2\left(\frac{n}{4}\right) \leq cn$  $c = \frac{1}{2}$

$$\therefore \underline{T(n) = \Theta(n)}$$

- $T(n) = 2T\left(\frac{n}{4}\right) + n^2$

$a = 2$, $b = 4$, $f(n) = n^2$

$n^{\log_4 2}$ vs. $n^2$

$n^{\frac{1}{2}}$ vs. $n^2$

case 3: $f(n) = \Omega\left(n^{\frac{1}{2}+\varepsilon}\right)$ $\qquad \varepsilon = 1\frac{1}{2}$.

and

$2\left(\frac{n}{4}\right)^2 \leq cn^2$ $\qquad c = \frac{1}{8}$

$\therefore \underline{\underline{T(n) = \Theta(n^2)}}$