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CIS 575: Intro to Algorithm Analysis

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1.)

$T(n) = 4T\left(\frac{n}{2}\right) + n^2$ $\qquad a = 4,\ b = 2,\ r = \ log_2\ 4$

$f(n) = \ n^2\ \in (n^2 lgn)\ \rightarrow\ T(n) \in\ \emptyset(n^2 lgn)$

$T(n) = 4T\left(\frac{n}{2}\right) + N$ $\qquad a = 4,\ b = 2,\ r = \ log_2\ 4$

$T(n) \in\ \emptyset(n^2)$

$T(n) = T(n+1) +\ n^2$ $\qquad a = 1,\ b = 1,\ r = \ log_1\ 1$

$T(n) \in\ \emptyset(n^2)$

2.)

1.) $T\left(\frac{n}{2}\right) + 3$

2.) $T(n) \in\ \emptyset(\lg(n))$

3.)

$T(n) = T([\frac{n}{3}]) + T([\frac{2n}{3}]) + n \qquad n \geq 3$

$\rightarrow IH \leq c([\frac{n}{3}]) \lg([\frac{n}{3}]) + c([\frac{2n}{3}]) \lg(3[\frac{2n}{3}]) + n$

$\leq c(\frac{n}{3}) \lg(n) + c(\frac{2n}{3}) \lg(2n) + n$

$= cn(\frac{1}{3} \lg(n)) + \frac{2}{3} \lg(2n) + n$

$= cn(\frac{1}{3} \lg(n) + \frac{2}{3}(\lg(2)) + \lg(n)) + n$

$= cn(\frac{1}{3} \lg(n) + \frac{2}{3} \cancel{\lg(2)} + \frac{2}{3} \lg(n)) + n$

$\cancel{= cn(\frac{1}{3} \lg(n) +}$

$= cn(\lg(n) + 2/3) + n \qquad f(n)$

$= cn(\lg(n)) + \frac{2}{3} cn + n \leq cn \lg(3n) \qquad \cancel{f(n)}$

$cn(\lg(n) + \frac{2}{3} cn + n \leq cn(\lg 3 + \lg n)$

$cn \lg(n) + 2/3\ cn + n \leq cn(\lg 3) + cn(\lg n)$

$\cancel{\lg(n)} + \frac{2}{3} + c \leq \lg(3) + \cancel{\lg(n)}$

$\frac{2}{3} + \frac{1}{c} \leq \lg(3)$

$\frac{1}{c} \leq \lg(3) - \frac{2}{3}$

$\frac{1}{c} \leq 0.9183$

$c \geq 1.08897$