ADA Assignment

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

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

$\Rightarrow a = 8, \quad b = 2, \quad f(n) = 1000n^2$

$d = 2$

Using Master's Theorem:

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

$8 > 2^2 \Rightarrow 8 > 4$

$\Rightarrow a > b^d$

$\therefore T(n) = O(n^{\log_b a})$

$= O(n^{\log_2 8})$

$= O(n^3)$

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

W.k.t

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

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

Using Master's Theorem: Time efficiency

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

$2 < 2^2 \Rightarrow 2 < 4 \Rightarrow a < b^d$

$\therefore T(n) = O(n^{\log_b a})$ $\boxed{T(n) = n^2}$

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

w.k.t $T(n) = aT(n/b) + f(n)$

$a = 2$, $b = 2$, $f(n) = 10n$, $d = 1$

Using Master's theorem: Time efficiency

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

$2 = 2^1 \Rightarrow a = b^d$

$T(n) = O(n^1 \log n)$

$\boxed{T(n) = O(n \log n)}$