The Master Theorem — Statement

The **Master Theorem**

Suppose $T(n) = a \cdot T(n/b) + f(n)$, where $a \geq 1$, $b > 1$, and $f(n)$ is $\Theta(n^d)$.

- “$n/b$” can be a nearby integer.

Compare $a$ to $b^d$.

- Case 1. If $a < b^d$, then $T(n)$ is $\Theta(n^d)$.
- Case 2. If $a = b^d$, then $T(n)$ is $\Theta(n^d \log n)$.
- Case 3. If $a > b^d$, then $T(n)$ is $\Theta(n^k)$, where $k = \log_b a$.

We may also replace each “$\Theta$” above with “$O$”.

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When analyzing an algorithm:

- $b$ = # of nearly equal-sized parts.
- $a$ = # of recursive calls.
- $f(n)$ = amount of other work.