

Cheat Sheet Efficient Algorithms

Paul

February 12, 2025

1 Utility

2 Recursion

2.1 Master Theorem

Let $a \geq 1$, $b > 1$, $\epsilon > 0$ then

$$T(n) = aT\left(\frac{n}{b}\right) + f(n) \tag{1}$$

then:

- If $f(n) = \mathcal{O}(n^{\log_b(a)-\epsilon})$ then $T(n) = \Theta(n^{\log_b a})$
- If $f(n) = \Theta(n^{\log_b a \log^k n})$ then $T(n) = \Theta(n^{\log_b a} \log^{k+1} n)$
- If $f(n) = \Omega(n^{\log_b(a)+\epsilon})$ and $af\left(\frac{n}{b}\right) \leq cf(n)$ for some $c < 1$ and sufficiently large n then $T(n) = \Theta(f(n))$