Design and Analysis
of Algorithms I

Master Method

The Precise Statement

The Master Method

Cool Feature : a "black box" for solving recurrences.

Assumption : all subproblems have equal size.

Recurrence Format

1. Base Case : T(n) <= a constant for all sufficiently small n
2. For all larger n :

$$T(n) \leq aT(n/b) + O(n^d)$$

where D important

a = number of recursive calls (>= 1)

b = input size shrinkage factor (> 1)

d = exponent in running time of "combine step" (>=0)

[a,b,d independent of n]

The Master Method

- $$T(n) = \begin{cases} O(n^d \log n) & \text{if } a = b^d \quad \text{(Case 1)} \\ O(n^d) & \text{if } a < b^d \quad \text{(Case 2)} \\ O(n^{\log_b a}) & \text{if } a > b^d \quad \text{(Case 3)} \end{cases}$$

Base doesn't matter (only changes leading constants)

Base matters