Time Analysis of Recursion

$T(n) = r \cdot T(n/c) + f(n)$ recursive definition

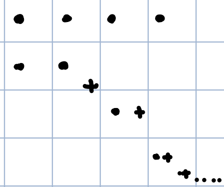
$= \sum_{i}^{L} r^i \cdot f(n/c^i)$ series definition

where $L = \log_c n$ // num levels

Decreasing case $(T_{i+1} < T_i)$

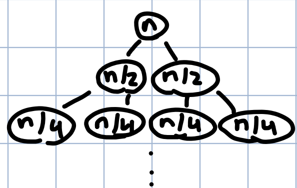
$O(f(n))$

$$n + n/2 + n/4 + \cdots = n + n/2 + n/3 \ldots \le \lim_{L \to \infty} n\left(\frac{1-\frac{1}{2}^L}{1-\frac{1}{2}}\right) = n \cdot 2$$



Constant case

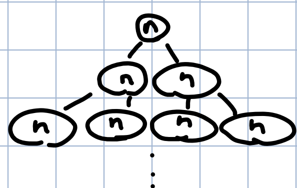
$O(f(n) \log n)$



$$= n + n + n + \cdots = \overbrace{n + n + n \ldots}^{\log n} = n \log n$$

Increasing Case $(T_{i+1} > T_i)$

$O(n^{\log_c r})$



$$= n + 2n + 4n + \cdots = \overbrace{n + 2n + 4n \ldots}^{\log n} \le 2^{\log n} + 2^{\log n} + 2^{\log n} \ldots$$