6.006 Recitation #1

9/11/09

Asymptotic or "big O" notation

For functions $f(x)$, $g(x)$, $O(g(x))$ is a class of functions such that $f(x) \in O(g(x))$ if there exist M, x_0 such that

$$|f(x)| \leq M \cdot |g(x)|$$

for all $x > x_0$.

Similarly, ~~$f(x) \in O(g(x))$~~ $f(x) \in \Omega(g(x))$ if $\exists\ M, x_0$ s.t. $|f(x)| \geq M \cdot |g(x)|$ for all $x > x_0$.

If $f(x) \in O(g(x))$ and $f(x) \in \Omega(g(x))$, then we write $f(x) \in \Theta(g(x))$.

Although $O(g(x))$ is really a class of functions, we will often write "$f(x) = O(g(x))$" when we mean "$f(x) \in O(g(x))$".

Exercise For the combinations of $f(n)$, $g(n)$ given, decide whether $f(n) = O(g(n))$, $f(n) = \Omega(g(n))$, or $f(n) = \Theta(g(n))$.

$g(n)$ \ $f(n)$	n^2	$n^{1.5}$	$\sqrt{2^n}$	$n\sqrt{\log n}$	$n \log_{30} n$	n^3
n	Ω	Ω	Ω	Ω	Ω	Ω
$n \log n$	Ω	Ω	Ω	Ω	Ω	Ω
n^2	Θ	O	Ω	O	Θ	Ω
$n^{1.5}$	Ω	Θ	Ω	O	Ω	Ω
$\sqrt{2^n}$	Ω	Ω	Θ	O	Ω	Ω
$n\sqrt{\log n}$	Ω	Ω	Ω	Θ	Ω	Ω
$n \log_{30} n$	Ω	Ω	Ω	Ω	Θ	Ω
n^3	Ω	Ω	Ω	Ω	Ω	Θ