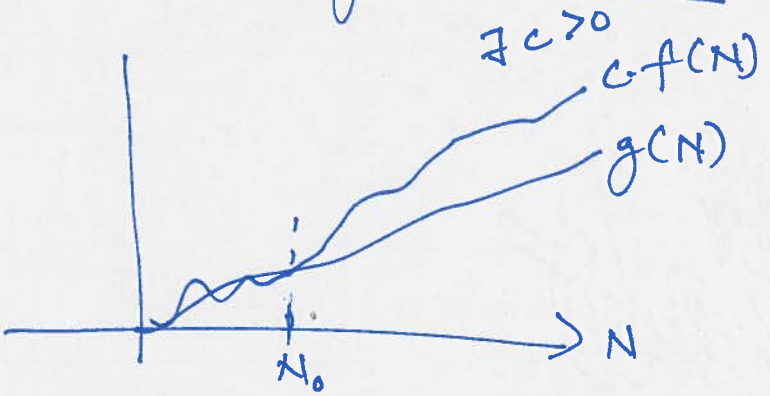
Sep 14

Big-Oh notation



$g(N)$ is $O(f(N))$

$10N+1 \stackrel{?}{=} O(\sqrt{N})$ ✗

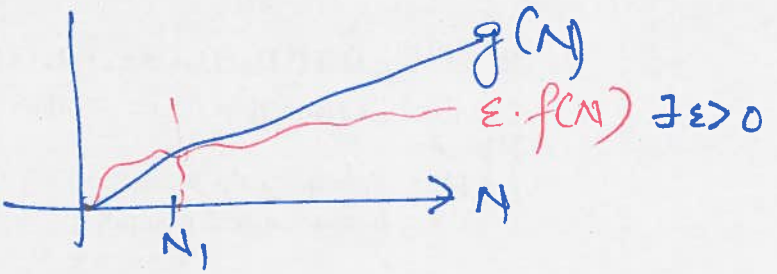
$O(N)$ ✓

$O(N^2)$ ✓

$O(N!)$ ✓

Big-Omega notation:

$g(N)$ is $\Omega(f(N))$



$10N+1 \stackrel{?}{=} \Omega(\sqrt{N})$

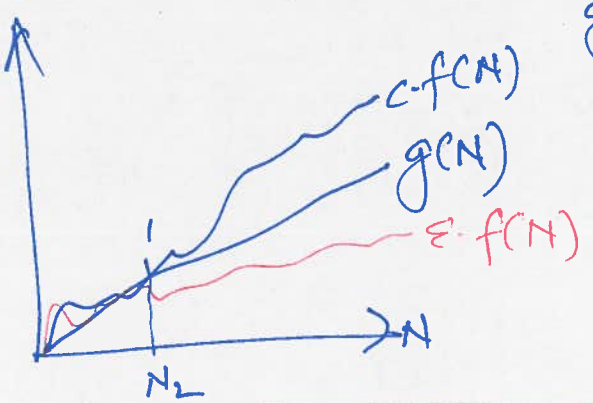
$\Omega(N)$

$\Omega(N^2)$

$\Omega(N!)$

Big-Theta notation:

$g(N)$ is $\theta(f(N))$ if $g(N)$ is $O(f(N))$ AND $g(N)$ is $\Omega(f(N))$



$10N+1 \stackrel{?}{=} \theta(\sqrt{N})$ ✗

$\theta(N)$ ✓

$\theta(N^2)$ ✗

$\theta(N!)$ ✗

Properties of O: (Also valid for Ω & θ)

① Transitive: $g(N)$ is $O(f(N))$ and $f(N)$ is $O(h(N))$
$\Rightarrow g(N)$ is $O(h(N))$

$10N+1$ is $O(N)$ & N is $O(N^2)$ $\Rightarrow$ $10N+1$ is $O(N^2)$

② Additive: $f(N)$ is $O(h(N))$ AND $g(N)$ is $O(h(N))$

$\Rightarrow f(N)+g(N)$ is $O(h(N))$

$10N$ is $O(N)$ & 1 is $O(N)$ $\Rightarrow$ $10N+1$ is $O(N)$

③ Multiplicative: If $f(N)$ is $O(h_1(N))$ and $g(N)$ is $O(h_2(N))$

$\Rightarrow f(N) \cdot g(N)$ is $O(h_1(N)\, h_2(N))$

$N \cdot 10 = O(N)$

$O(N)$ ↑ $O(1)$