Lecture Assigment 2

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1a. ~~(a)~~ n^2

(a) $n^2 \to (2n)^2 = 4n^2$ increase by factor of 4

b) $n^2 \to (n+1)^2 = n^2 + 2n + 1$ increase by $2n+1$

(b). n^3

a. $n^3 \to (2n)^3 = 8n^3$ increase by factor of 8

b. $n^3 \to (n+1)^3 = n^3 + 3n^2 + 3n + 1$ increased by $3n^2 + 3n + 1$

c). $100n$

a). $100n^2 \to (\cancel{4}00n^2) = 2^2(100n^2)$ increased by factor of 4

b). $100n^2 \to 100(n^2+1) = 100n^2 + 200n + 100$ increased by

$200n + 100$.

d). $n\log n$

a). $n\log n \to (2n\log 2n) = n\log(2n)^2 = n\log 4n^2$

$= n(\log n + \log 4n)$

$= n\log n + n\log 4n$

$= n\log n + n(\log n + \log(4))$

$= n\log n + n\log n + n\log n$

$= 2n\log n + 2n$ $(\log n = \log_2 n)$

increased by factor of 2 plus $2n$.

b. $n\log n \to (n+1)\log(n+1) = n\log(n+1) + \log(n+1)$

~~Let~~ remove $n\log n$

$\Rightarrow n\log(n+1) + \log(n+1) - n\log n = \cancel{n\log(n+1)+}$

$= \log(n+1) + n[\log(n+1) - \log n]$

increased by $\log(n+1) + n[\log(n+1) - \log n]$.

(e). 2^n

a. $2^n \to 2^{2n} = (2^n)^2$ increased by square factor

b). $\cancel{2^n \to 2^{2(n+1)} = 2^{2n+2} = 4\cdot 2^{2n}}$ ~~increased by factor of 4.~~

$2^n \to 2^{n+1} = 2\cdot 2^n$ increased by factor of 2.

5. given $f(n) = O(g(n))$, $f(n) \leq c\, g(n)$

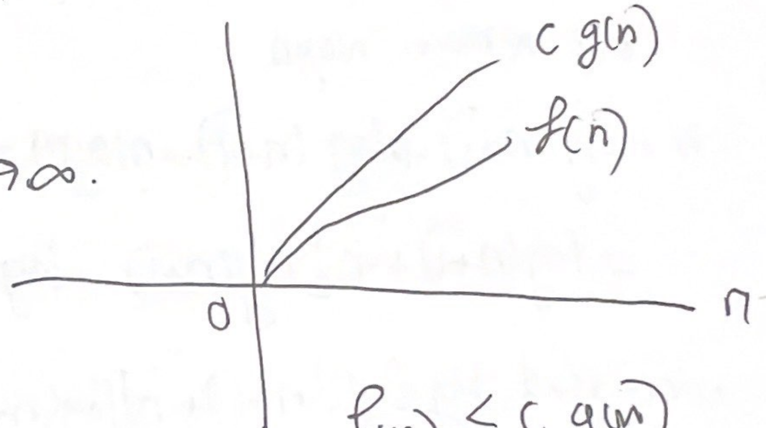
a). False, $f(n) = 2$, $g(n) = 1$, $\log(g(n)) = 0 \Rightarrow \log f(n) > \log(g(n))$

b). False, $f(n) = 2n$

$g(n) = n$

$f(n) \leq c \cdot g(n)$ ($f(n) = O(g(n))$

$\Rightarrow 2^{2n} > c\, 2^{n}$ as $n \to \infty$.



$f(n) \leq c\, g(n)$

c. True

$f(n) \leq c\, g(n)$

$f(n)^2 \leq c^2 g(n)^2$ for any $n \leq n_0$