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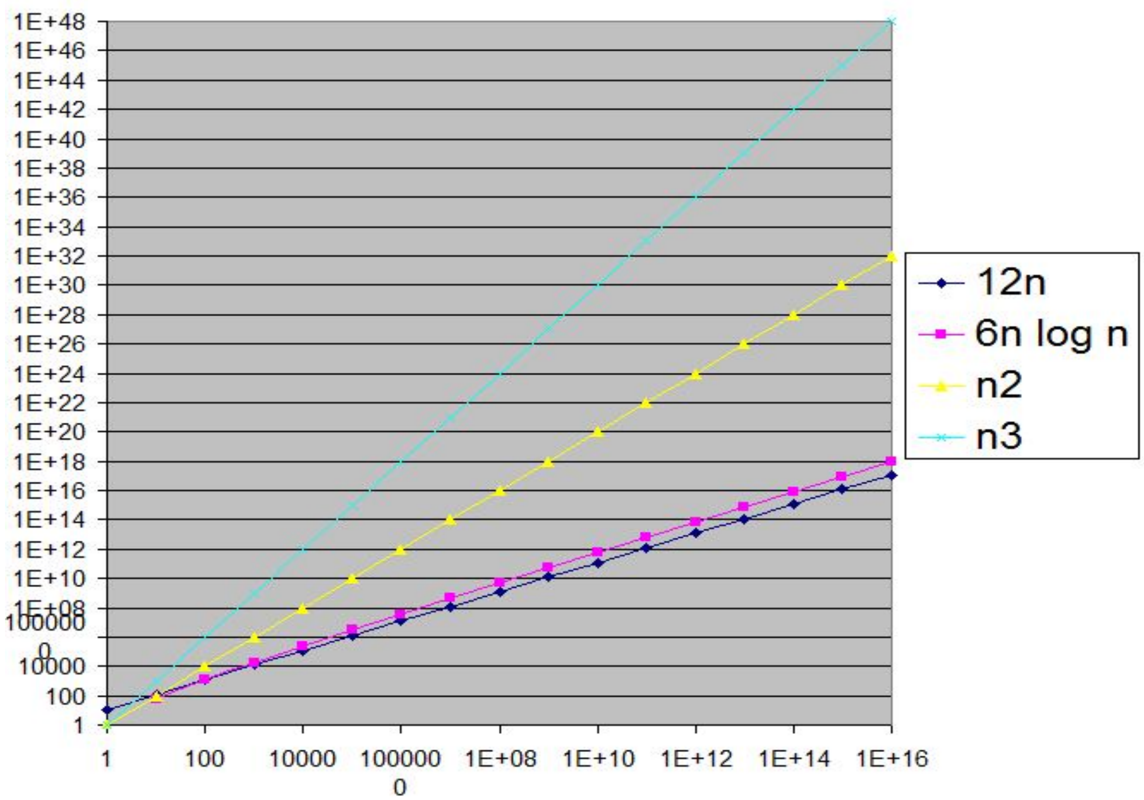
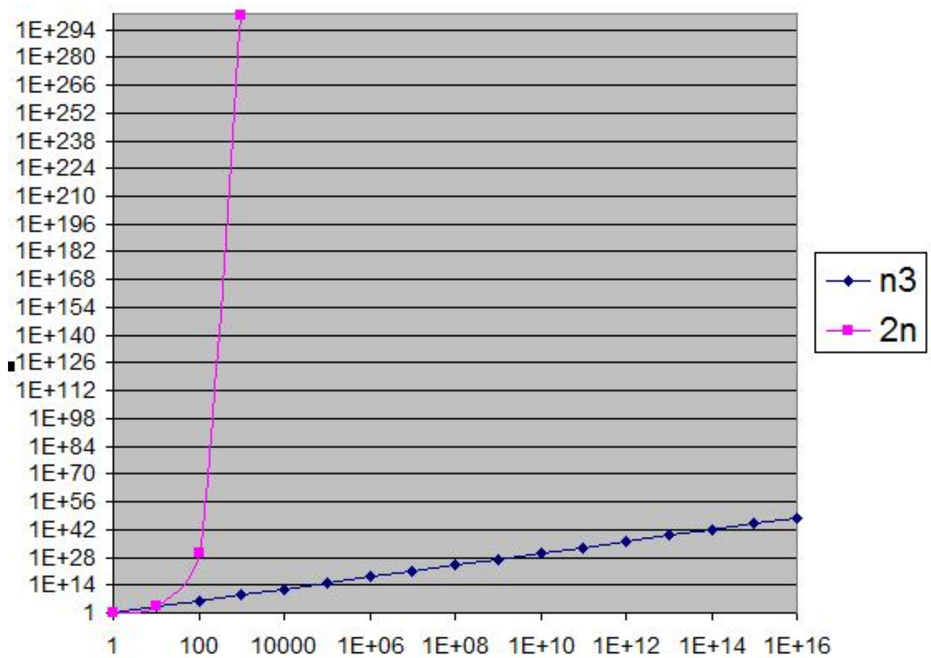
Assignment 1

R-1.1 Graph the functions 12n, 6n log n, n^2, n^3, and 2^n using logarithmic scale for the x- and y-axes; that is, if the function value f(n) is y, plot this as a point with x-coordinate at log n and y-coordinate at log y.

⇨ **R.1.1 answer:**





R-1.2 Algorithm A uses 10n log n operations, while algorithm B uses n^2 operations. Determine the value n_0 such that A is better than B for $n \geq n_0$.

⇨ **R-1.2 Answer:**

For $n_0 = 100$,

$10n\log n = 10 * 100 * 10 = 10000$

$n^2 = (100)^2 = 10000$

For $n_0 > 100$, A is better than B.

R-1.6 Order the following list of functions by the big-O notation.

R-1.6 Answer:

$1/n < \log\log n < \sqrt{n} < 5n < n\log n < 2n\log^2 n < 4n^{3/2} < 4^{\log n} < n^2\log n < n^3 < 2^n < 4^n$

R-1.10 Give a big-O characterization, in terms of n, of the running time of the Loop1 method below:

R-1.10 Answer:

Algorithm Loop1(n)	
$s \leftarrow 0$	O(1)
for $i \leftarrow 1$ to n do	O(n)
$s \leftarrow s + i$	O(n)
	Total running time = O(n)

R-1.14 Perform a similar analysis for method Loop5 below:

R-1.14 Answer:

Algorithm Loop5(n)	
$s \leftarrow 0$	O(1)
for $i \leftarrow 1$ to n^2 do	$O(n^2)$
for $j \leftarrow 1$ to i do	$O(n^4)$
$s \leftarrow s + i$	$O(n^4)$
	So total running time = $O(n^4)$

Prove: $\log_b x^a = a \log_b x$

From the definition, $Y = \log_b x$

$\Rightarrow x = b^Y$

$\Rightarrow x^a = (b^Y)^a$

$\Rightarrow \log_b X^a = Ya$

$\Rightarrow \log_b X^a = a \log_b X$