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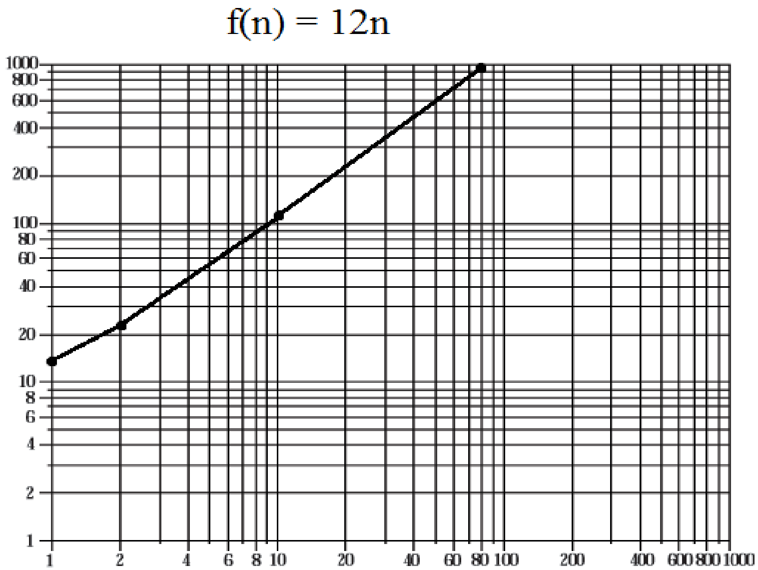
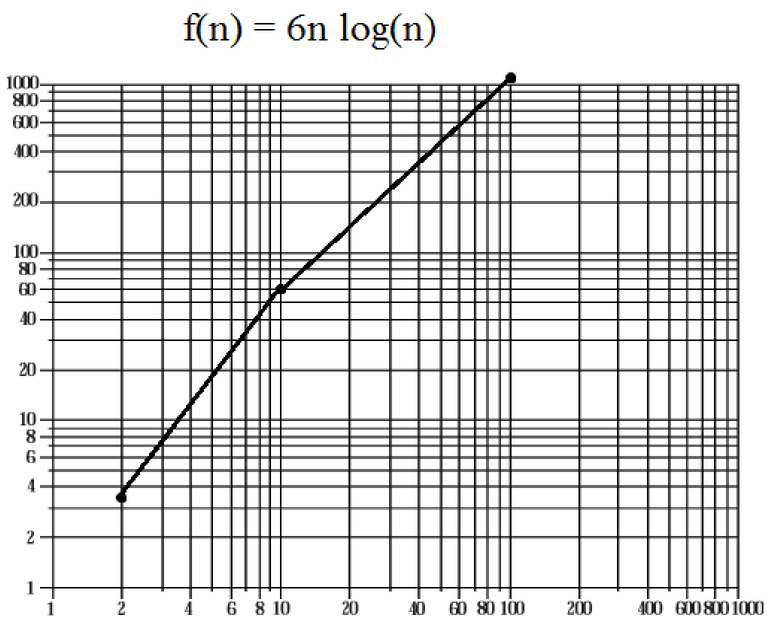
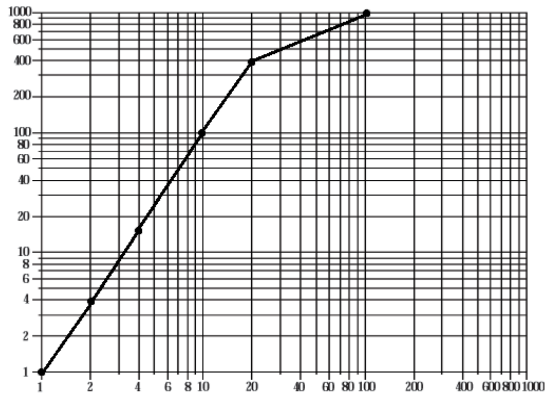
R-1.1 Graph the functions 12n, 6n log n, n 2 , n 3 , and 2n using logarithmic scale for the xand y-axes; that is, if the function value f(n) is y, plot this as a point with x-coordinate at log n and y-coordinate at log y.

Solution:

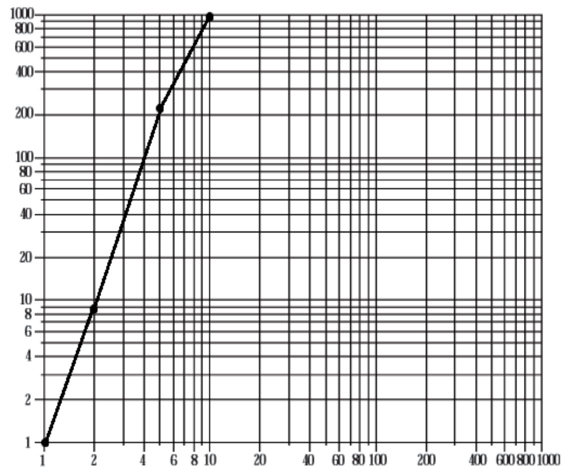




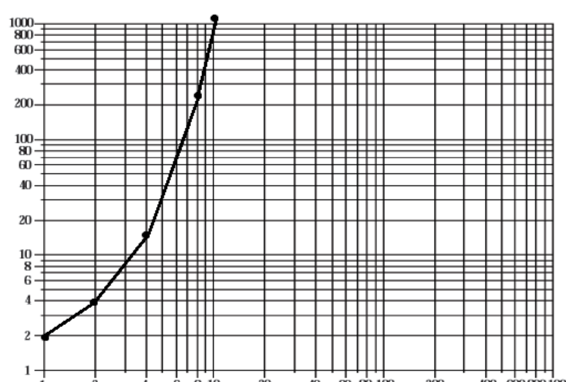
f(n) = n^2



f(n) = n^3



f(n) = 2^n



R-1.2 Algorithm A uses 10n log n operations, while algorithm B uses n^2 operations. Determine the value n0 such that A is better than B for n ≥ n0.

Solution:

For $n_0 = 100$

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

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

For $n_0 > 100$, A

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

Solution:

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

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

Solution:

Algorithm Loop1(n)

$s \leftarrow 0$ $O(1)$
for $i \leftarrow 1$ to n do $O(n)$
$s \leftarrow s + i$ $O(n)$

Total $= O(n)$

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

Solution:

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 $O(n^4)$
$s \leftarrow s + i$ $O(n^4)$

Total $= O(n^4)$

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

Solution:

Assume,

$z = a\log_b x$

Raising with b on both sides:

$b^z = b^{a\log_b x} = (b^{\log_b x})^a$

or, $b^z = (x)^a$

Taking log on both sides,

$\log_b (b^z) = \log_b (x)^a$

or, $z = \log_b (x)^a$

or, $a\log_b x = \log_b x^a$

Proved