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HW#1 Asymptotic Notation Exercise

Definitions:

a) Define Big O notation in your own words.

Big O defines the upper bound of a function

b) Define Big Omega (Ω) notation in your own words.

Big Ω defines the lower bound of a function

c) Define Big Theta (Θ) notation in your own words.

Big θ defines both the lower and upper bound

d) How does Big Theta relate to Big O and Big Omega?

It consists of both the lower and upper bound

Classifications:

a) Is $f(n) = 2n + 5$ *in* $O(n)$? Explain.

Yes, Because the highest order term in the function is 2n, therefore Big O is, O(n).

b) Is $f(n) = n^2 + 3n$ *in* $\Omega(n)$? Explain.

No, because 3n becomes negligible compared to n^2, because of that the function isnt in Ω(n).

c) Is f(n)= $3n^2$ + 2n+1 in Θ(n^2)? Explain.

Yes, because the function grows exacty like n^2

d) Is f(n)= 2^n+ n^2 in O(2^n)? Explain.

Yes, because 2^n dominates the function, so f(n)=O(2^n)

Rules for Combining Functions:

a) If f(n) is in O(g(n)) and h(n) is in O(g(n)), is f(n)+h(n) in O(g(n))? Explain.

Yes, because both f and h are bounded by g

b) If f(n) is in O(g(n)), is c□f(n) in O(g(n)) for any constant c? Explain.

Yes, because multiplying by a constant doesnt change

c) If f(n) is in O(g(n)) and h(n) is in O(k(n)), is f(n)□h(n) in O(g(n)□k(n))? Explain.

Yes, because if 2 functions are bounded by different multiples, it will result in a bound that combines both

Comparing Functions:

a) Rank the following functions in order of increasing growth rate:

$n^2,\ \log n,\ n\ \ 2^n\ \ n\log n$

$2^n > n^2 > n\log n > n > \log n$

b) Given f(n) = n^3 and g(n) = , which function grows faster as n approaches infinity?

n^3 ?

5. True or False:

a) If f(n) is in O(g(n)), then f(n) is also in Ω(g(n)). True

b) If f(n) is in Θ(g(n)), then f(n) is also in O(g(n)) and Ω(g(n)). True

c) If f(n) is in O(g(n)) and f(n) is in Ω(g(n)), then f(n) is in Θ(g(n)). False