



Design and Analysis of Algorithm (CS 412)

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CS 6th

SIS ID: _____

Name: _____

A. Identify whether each of the following statement is true or false. Justify your answer.

1. $n^3 + \Theta(n) = \Theta(n^3)$ (T/F)

True, n^3 is the highest degree term (dominating term) of the polynomial. $f(n)$ is $\Theta(n)$ iff $f(n) = O(n)$ and $f(n) = \Omega(n)$; n^3 is $O(n^3)$ and $\Omega(n^3)$ implies n^3 is $\Theta(n^3)$, hence $n^3 + \Theta(n) = \Theta(n^3)$

2. $f(n) = o(g(n))$ and $g(n) = o(h(n))$ imply $f(n) = o(h(n))$ (T/F)

True. By Transitive property if $f(n) < g(n)$ and $g(n) < h(n)$ it implies that $f(n) < h(n)$

3. $f(n) = O(f(n))$ (T/F)

Reflexive property. Also, by definition of Big-O notation, $f(n) = O(f(n))$ if $f(n) \leq c \cdot f(n)$. For $c=1$, the condition $f(n) \leq c \cdot f(n)$ hold for all $n_0 > 0$

B. Is $2^{n+1} = O(2^n)$? if yes, give values for c and n_0 .

Yes

$$2^{n+1} = O(2^n)$$

$$2^{n+1} \leq c \cdot 2^n$$

$$2 \cdot 2^n \leq c \cdot 2^n$$

The condition holds for $c=2$ for all $n_0 > 0$

C. Given that, $200n^2 + 20n + 2 = O(n^2)$, find out the value of c if $n_0 = 10$.

$$200n^2 + 20n + 2 \leq c \cdot n^2$$

$$200 + 20/n + 2/n^2 \leq c$$

For $n=10$,

$$200 + 20/10 + 2/100 \leq c$$

$$200 + 2 + 0.02 \leq c$$

$$c \geq 202.02$$

