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CIS 352 Homework 5

1 $f(n) \in \Omega(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = \infty$$

This is true as n^3 grows much faster than n^2

2 $f(n) \in \Omega(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = \infty$$

This is true, as $g(n)$ is a logarithmic function while $f(n)$ is a polylogarithmic function which grows faster

3 $f(n) \in \Omega(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = \infty$$

This is true because $49n$ being a linear function, grows faster than the logarithmic function $g(n)$

4 $f(n) \in O(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = 0$$

This is true because 6^n grows much faster than $6^{n/2}$

5 $f(n) \in O(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = 0$$

This is true because $g(n)$ is an exponential which grows faster than $f(n)$ (a polynomial)

6 $f(n) \in \Theta(g(n))$

As
$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = 1$$

If we take the $\lim_{n \to \infty}$ of $\frac{17^{\log_2(n)}}{n^{\log_2(17)}}$ we get 1

$\therefore f(n) \in \Theta(g(n))$

7 For the second equation it is not a problem. In dealing with asymptotic notation we drop the less significant terms and coefficients, so

$g(n) = (9 + 2\cos(n))n + 12n^2$

n^2 is all that matters. So we end up with

$\lim_{n \to \infty} \frac{n^2}{n^2} = 1$ so $g \in \Theta(n^2)$

For the first part what cause the issue is cos as it does not have a limit when n goes to infinity

8 n, as there is one loop that runs n times

9 n^2, as the outer loop will run n times while the inner loop will run n times for every n, so it will run $n \cdot n$ or n^2

10 n^2, this loop follows the same logic as the previous one with j being decremented instead of incremented in 9

11 $\log_2(n)$ as for any value of n, m will be incremented by $m \times 2$, and with m being compared to n it will run $\log_2(n)$