CIS 3223 Miniquiz 1

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Name: Solutions
Temple ID (last 4 digits:

1 (15 pts) Complete the following table by writing T or F in each box, where T represents "true " and F represents "false ". No justification required.

f	g	$f = O(g)$	$f = \Omega(g)$
3^{n+2} $<$	5^n	T	F
$2n + \log n$ $=$	$n + (\log n)^2$	T	T
2^n $<$	$5^{n/2}$	T	F
n $>$	$(\log n)^{100}$	F	T
$n!$ $>$	4^n	F	T
$n^{0.1}$ $>$	$(\log n)^{10}$	F	T
n $<$	$\sum_{k=1}^{n} \log k$	T	F

What is the most dominant function in the table? $\boxed{n!}$

2 (5 pts) **Give** as good big$-\theta$ estimate for each of the following functions.

(a) $f(n) = (n^4 + 2^n)(n^3 + \log(n^4 + 1))$ $\boxed{\theta(n^3 2^n)}$

2^n $\quad$ n^3

(b) $f(n) = (4n^2 \log(3^n + 1) + n^4)(n! + n3^n)$ $\boxed{\theta(n^4 n!)}$

n^4 $\quad$ $n!$

3 (**Bonus** 1 pt) Does f_n divide f_{2n}, $n \geq 1$ YES NO

$$\begin{bmatrix} f_{2n+1} & f_{2n} \\ f_{2n} & f_{2n-1} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}^{2n} = \left(\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}^{n}\right)^2 = \begin{bmatrix} f_{n+1} & f_n \\ f_n & f_{n-1} \end{bmatrix}^2 = \begin{bmatrix} * & f_{n+1}f_n + f_n f_{n-1} \\ * & * \end{bmatrix}$$

$$f_{2n} = f_{n+1} f_n + f_n f_{n-1} = f_n (f_{n+1} + f_{n-1})$$