CIS 3223 HW 2

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Name:
Temple ID (last 4 digits:

You may use a simple non-graphing calculator (make): ____________

1 Complete the following table by writing 1 or 0 in each box, where 1 represents "true " and 0 represents "false ". No justification required. For each row, enter the number represented (1010 gives 10).

f	g	$f = O(g)$	$f = \Omega(g)$	$f = o(g)$	$g = o(f)$	number
$\sqrt{n}$	$\log(1+n^2)$					
$(\log n)^{10}$	$n^{0.1}$					
3^{n+2}	. 5^n					
$2n + \log n$	$n + (\log n)^2$					
2^n	$5^{n/2}$					
n	$\sum_{k=1}^{n} \log k$					

What is the most dominant function in the table?

Give as good big$-\theta$ estimate for each of the following functions.

(a) $f(n) = (n^4 + 2^n)(n^3 + \log(n^4+1))$

(b) $f(n) = (4n^2 \log(2^n + 1) + n^4)(n! + n2^n)$

2 Give a big-θ bound for the solutions of the following recurrence relations.

(a) $T(n) = 8T(n/3) + 1000n^2$

(b) $T(n) = 5T(n/4) + 7n$

(c) $T(n) = 2T(n/2) + \sqrt{n}$

(d) $T(n) = T(n-1) + n^2$

3 Use strong induction to prove the following: $F_n \leq 2^{0.7n}, \quad n \geq 1$

Base cases: Show true for $n = 1$ and 2:

$n = 1:$
lhs $= F_1 = 1$
rhs $= 2^{0.7} = 1.6245$
So lhs $\leq$ rhs. True for $n = 2$

$n = 2:$
lhs $= F_2 = 1$
rhs $= 2^{1.4} = 2.6390$
So lhs $\leq$ rhs. True for $n = 2$

Inductive case: Assume true for $n = s, \; 1 \leq s \leq k, \; k \geq 2$

Show true for $n = k + 1$:

lhs $=$

(Bonus 2 pts) Can you improve on 0.7 using 2 decimal precision?

$F_n \leq 2$ ____ ^{n} $\qquad n \geq$ ____