EECS340 - Algorithms - HW#2

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3.3

a)

$2^{2^{n+1}}$	2^{2^n}	$(n+1)!$	$n!$	e^n
$n \cdot 2^n$	2^n	$(\frac{3}{2})^n$	$(\lg n)^{\lg n} = n^{\lg \lg n}$	$(\lg n)!$
n^3	$n^2 = 4^{\lg n}$	$n \lg n = \lg(n!)$	$n = 2^{\lg n}$	$(\sqrt{2})^{\lg n}$
$2^{\sqrt{2 \lg n}}$	$\lg^2 n$	$\ln n$	$\sqrt{\lg n}$	$\ln \ln n$
$1 = n^{1/\lg n}$				

b) First we find a value for $f(n)$ that is larger than any value in the table. $f(n) = 2^{2^{n+2}}$. Then to make $f(n)$ cover the whole range without being negative we multiply by $(\sin(n) + 1)$ therefore $f(n) = (\sin(n) + 1) \cdot 2^{2^{n+2}}$

3.4

a) The counter proof is $n = O(n^2)$ but $n^2 \neq O(n)$.

b) The counter proof is $n^2 1 + n \neq \Theta(n)$

c)

$$
\begin{aligned}
f(n) = O(g(n)) &\Leftrightarrow 0 \le f(n) \le c \cdot g(n) \text{ for some } c > 0 \text{ and all } n > n_0 \\
&\Rightarrow \lg(f(n)) \le \lg(c \cdot g(n)) \\
&\Rightarrow \lg(f(n)) \le \lg c + \lg(g(n)) \le c_2 \cdot \lg(g(n)) \text{ for some } c_2 > 1 \\
&\Rightarrow \lg(f(n)) = O(\lg(g(n)))
\end{aligned}
$$

d) The counter proof is $2n = O(n)$ but $2^{2n} = 4^n \neq O(2^n)$

e) The counter proof is $f(n) = 1/n \neq O(1/n^2)$

f)

g) The counter proof is $4^n \neq \Theta(4^{n/2} = 2^n)$

h)