6.)

a.) This is impossible, if $f_1(n)$ is the upper bound for $f_2(n)$ than $f_2(n)$ cannot also be the upper bound for $f_1(n)$. BUT

$f_1(n) = O(f_2(n))$ implies c_1 and n_0 that $0 \le f_1(n) \le c_1 f_2(n)$ for all $n \ge n_0$.

Above implies $f_2(n) = O(f_1(n))$

$f_2(n) = O(f_1(n))$ implies c_2 and n_1 that $0 \le f_2(n) \le c_2 f_1(n)$ for all $n \ge n_1$

By definition $f_1(n) = O(f_2(n))$ requires $f_2(n)$ to be greater than $f_1(n)$ thus this statement is false.

b.) If $f_1(n) = O(g_1(n))$ and $f_2(n) = O(g_2(n))$, then $f_1(n)\times f_2(n) = O(g_1(n)\times g_2(n))$.

Proof:

$f_1(n) \le c_1g_1(n)$ and $f_2(n) \le c_2g_2(n)$ for large n thus,

$f_1(n)*f_2(n) \le c_1g_1(n)*c_2g_2(n)$

$\le c_1\max(g_1(n),g_2(n)) + c_2\max(g_1(n),g(n))$

$\le (c_1+c_2)\max(g_1(n),g_2(n))$