1. Prove Theorem 3.1: “for any two functions $f(n)$ and $g(n)$, we have $f(n) = \Theta(g(n))$ if and only if $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$.”

2. Are the following claims generally true for asymptotically positive functions $f(n)$ and $g(n)$? Justify your answers.
   a) $f(n) = O(g(n))$ implies $g(n) = O(f(n))$.
   b) $f(n) = O(g(n))$ implies $g(n) = \Theta(f(n))$.
   c) $f(n) = O(g(n))$ implies $2^{O(n)} = O(2^{O(n)})$.
   d) $f(n) = O((f(n))^3)$.
   e) $f(n) + g(n) = \Theta(\min(f(n), g(n)))$.
   f) $f(n) = \Theta(f(n/2))$.
   g) $f(n) = o(f(n))$.
   h) $3^n = 2^{O(n)}$.

3. Show that the solution of $T(n) = T(n-1) + n$ belongs to $O(n^2)$.

4. Consider the recurrence $T(n) = 4T(\lfloor n/2 \rfloor) + cn$, in which $c$ is a nonnegative constant. Verify the bound $T(n) = \Theta(n^2)$ by using the substitution method.