1. Guess (and verify) in linear time that \( A \) is sorted. If \( A \) is sorted, return the middle value, otherwise sort it and return the middle value.

\[
\begin{align*}
\textit{sorted} & \leftarrow \text{true} \\
\textbf{for} \ k & \leftarrow 1 \ \textbf{to} \ n-1 \ \textbf{do if} \ A[k] > A[k+1] \ \textbf{then} \ \textit{sorted} \leftarrow \text{false} \\
\textbf{if not} \ \textit{sorted} \ \textbf{then} \ \text{INSERTIONSORT}(A) \\
\textbf{return} \ A[(n+1)/2]
\end{align*}
\]

2. \( \{(1/3)^n\}, \{\lg \lg n\}, \{\lg n, \ln n\}, \{n^{1/2}, \sqrt{n} + \lg n\}, \{\sqrt{n} * (\lg n)^2\}, \{n\}, \{n^* \lg n\}, \{n^2, n^2 + \lg n\}, \{n^{1^1}\}, \{2^n\}, \{n!\} \)

3. (a) The Conjecture is true. For any \( f \), choose \( n_0 = 1 \) and \( c = 1 \). For all \( n \geq 1 \) it follows that

\[ f(n) \leq f(n) \].

(b) The Conjecture is false. Choosing \( f(n) = 1 \) and \( g(n) = n \), we see that \( c_0 = 1 \) and \( n_0 = 1 \) yields that for all \( n = 1 \), \( 1 = 1^* n \). Hence \( f(n) \in O(g(n)) \). But in the other direction, if \( g(n) \in O(f(n)) \), then there must exist \( c_1 \) and \( n_1 \) such that for all \( n = n_1 \), \( g(n) = n = c_1^* f(n) = c_1 \). Choosing \( n = \max\{c_1, n_1\} + 1 \) forces a contradiction.

(c) Since \( f(n) \in O(g(n)) \) and \( g(n) \in O(h(n)) \), then there exist \( c_0, n_0, c_1, n_1 \), such that \( f(n) = c_0^* g(n) \) and \( g(n) = c_1^* h(n) \) for all \( n = \max\{n_0, n_1\} \). But \( f(n) = c_0^* g(n) = c_0^* c_1^* h(n) \) for all \( n = \max\{n_0, n_1\} \). Letting \( n_2 = \max\{n_0, n_1\} \) and \( c_2 = c_0^* c_1 \) assures that \( f(n) \in O(h(n)) \).