Problem 1: Prove that the Big-O relation is transitive. That is, if \( f(n) = O(g(n)) \) and \( g(n) = O(h(n)) \) then \( f(n) = O(h(n)) \).

Problem 2: For each pair of functions determine their asymptotic relation, i.e., \( \omega, \Omega, \Theta, O \) or \( o \). You don’t need to justify your answer. If several apply, list them all.

\[
\begin{align*}
\log n &\quad \log n^{10} \\
\log n! &\quad n \\
2^n &\quad n^n \\
e^n &\quad n! \\
n^{\frac{1}{\log n}} &\quad 20 \\
n^{\log n} &\quad (\log n)^n
\end{align*}
\]


Problem 4: In class we showed that the number of iterations of the Gale-Shapley algorithm for finding a stable matching is at most \( n^2 \). Show that this is asymptotically tight by giving an instance where the number of iterations is \( \Omega(n^2) \).