The Theory of Computation
Bernard M.E. Moret
Addison-Wesley-Longman, 1998

Solution Manual
Chapter 8, Problem 8.28

Recall that $len(I) = |I|$ is the length of the instance in a reasonable encoding, $f(I)$ is the value of the optimal solution for I, and $max(I)$ is the size of the instance in unary encoding.

A problem is p-simple if there exists a bivariate polynomial p such that instance I can be solved in time $p(len(I), f(I))$. The theorem we are to prove states that an NPO problem such that there exists polynomials q_1 and q_2 with $f(I) = O(q_1(max(I))$ and $max(I) = O(g_2(len(I), f(I)))$ is p-simple if and only if it can be solved in pseudopolynomial time.

Both parts fall to simple substitution.

If the problem can be solved in polynomial time, there exists some polynomial q such that instance I can be solve in $O(q(max(I))$ time. But then it can be solved in $O(q(g_2(len(I), f(I)))$ time; writing $p = q \cdot g_2$, we conclude that instance I can be solved in $O(p(len(I), f(I)))$ time, as desired.

Conversely, if instance I can be solved in $p(len(I), f(I))$ time, then, by assumption, it can be solved in $p(len(I), g_1(max(I)))$ time. But we have $max(I) \geq len(I)$ for all I, so we can write

$$p(len(I), g_1(max(I))) \leq p(max(I), g_1(max(I)))$$

so that there exists some polynomial q such that

$$p(max(I), g_1(max(I))) \leq q(max(I))$$

and thus instance I can be solved in $q(max(I))$ time, which is pseudopolynomial time.