Introduction to Computation and Complexity
Exercise Sheet 4

Adrien Pommellet, EPITA

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Exercise 1

Prove that the function $n \to n \cdot \lceil log_2(n) \rceil$ is a time-constructible function.

Hint: if $2^n < x \leq 2^{n+1}$, then $\lceil log_2(x) \rceil = n + 1$.

Exercise 2

Prove the following theorem:

Theorem 1 (Padding property) *Given a language L, let $L' = \{w \# 0^{2^{|w|}} \mid w \in L\}$. Then $L \in$ `EXP` if and only if $L' \in$ `P`.*

Hint 1: keep in mind that $n \to 2^n$ is time-constructible.

Hint 2: intuitively, we are merely cheating the definition of time complexity by padding the input with superfluous information to make it bigger, then claiming that the time complexity is polynomial with regards to the size of the inflated input.