

Homework Assignment 4 - Time and space complexity

Deadline: 4.1.2022, 12:20 in Moodle.

Problem 1. Show that $DYCK = \{w \in \{(,)\}^*, w \text{ is a well parenthesized expression}\}$ belongs to LOG . For example: $((()))$, $()$, $((()))$ are in $DYCK$, but $)$, $($ aren't.

Problem 2. Let A be a language and $A' = \{x\#0^{|x|^2-|x|-1}; x \in A\}$. Show that $A \in DTIME(n^3)$ if and only if $A' \in DTIME(n^{3/2})$.

Problem 3. Show that if $DTIME(n^3) \neq DTIME(n)$ then $DTIME(n^2) \neq DTIME(n)$ and $DTIME(n^{3/2}) \neq DTIME(n)$. Similarly for any rational constants $c' > c > 1$, $DTIME(n^c) \neq DTIME(n^{c'})$. (*Hint:* Use the previous problem.)

Problem 4. Show that $QBF \notin DSPACE(n^{1/10})$.

Problem 5. Order by inclusion the classes $EXP, L, NL, NP, P, PH, PSPACE$ and mark which of the inclusions are proper.