

Exercise 5

Task 1. Let $f(n) = n^k$. Show for $L \neq \Sigma^*$ and $L \neq \emptyset$:

$$\text{Pad}_f(L) \leq_m^{\log} L.$$

Task 2. Show that ACYCLIC (Exercise 4) is **NL**-complete.

Task 3. Suppose that $L_1 \leq L_2$ and $\mathbf{P} \neq \mathbf{NP}$. Answer and briefly justify

1. if L_1 is in \mathbf{P} , L_2 is in \mathbf{P} , ?
2. if L_2 is in \mathbf{P} , L_1 is in \mathbf{P} ?
3. if L_1 is **NP**-complete, is L_2 **NP**-complete?
4. if L_2 is **NP**-complete, is L_1 **NP**-complete?
5. if $L_2 \leq L_1$, are L_1 and L_2 **NP**-complete?

Task 4. Let TAUTOLOGY denote the set of propositional formulas that evaluate to **true** for all possible assignments of truth values to the variables. Show that TAUTOLOGY is **coNP**-complete.