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Exercise 2

Task 1. Prove statement 3 of Lemma 2 (slide 9).

Task 2. Show that the following languages are in **L** by constructing Turing machines for these languages.

1. $L_1 = \{a^n b^n c^n | \, n \geq 1\}$
2. $L_2 = \{v\$v | \, v \in \Sigma^*\}$

Task 3. Prove the statement on slide 22.

Task 4 (Nondeterministic Logspace)**.** A directed graph $G = (V, E)$ is called *strongly connected*, if for all pairwise distinct nodes v_i, v_j there is a directed path from v_i to v_j.
Does the problem
Input: A directed graph $G = (V, E)$.
Question: Is G strongly connected?
belong to the complexity class **NL**?

Task 5 (Deterministic Logspace)**.** Does the problem
Input: An integer $N \in \mathbb{N}$ in *unary* encoding.
Question: Is N a prime number?
belong to the complexity class **L**?