

HW 7 Due: 14 mar 2025

1. Consider the language

$$L = \{w \in \{a, b\}^* : \text{the longest run of } a\text{'s in } w \text{ is longer than any run of } b\text{'s in } w\}.$$

For example, $abbbbaabbbbaaaaaa \in L$ because the longest run of b 's in it has length four, while the longest run of a 's has length six. Prove that L is not context-free. 50

2. Consider the language $L = \{\alpha\beta\beta^R\gamma : \alpha, \beta, \gamma \in \{a, b\}^+ : |\alpha| \geq |\gamma|\}$. Is it regular? Context-free? Not even context-free? Give a proof of your answer. (This exercise requires some thought!) 100
3. Define a NPDA for the language $L = \{a^{2n}b^n : n \in \mathbb{N}\}$. 50
4. Define a NPDA for the language $L = \{uv \in \{0, 1\}^* : |u| = |v| \wedge u \neq v^R\}$. 50