

Theory of Computation, Fall 2021

Assignment 4 (Due October 29 Friday 9:35am)

- Q1. [2, Exercise 2.4.5] Use pumping theorem to show that the language $\{ww^R : w \in \{a, b\}^*\}$ is not regular.
- Q2. Let M be a DFA. Let p be the number of states in M . Is the following statement true or false? Briefly explain your answer.
- If $L(M)$ has a string w with $|w| \geq p$, then $L(M)$ must be infinite (That is, $L(M)$ contains an infinite number of strings).
- Q3. [2, Problem 3.1.3 and 3.1.9] Construct context-free grammars that generate each of the following languages. Your grammars should have as few rules as possible.
- (a) $\{w \in \{a, b\}^* : w = w^R\}$
- (b) $\{a^m b^n : m \geq n\}$
- Q4. Let $N = (K, \Sigma, \Delta, s, F)$ be an NFA. Construct a PDA $P = (K', \Sigma, \Gamma, \Delta', s', F')$ such that $L(P) = L(N)$.
- Q5. [2, Problem 3.3.2] Construct a PDA that accepts $\{w \in \{a, b\}^* : w \text{ has twice as many } b\text{'s as } a\text{'s}\}$. (Hint: use the stack to track the value of $B - 2A$ where B (A , resp.) is the number of b 's (a 's, resp.) that have already been read by the PDA.)
- Q6. Convert the CFG you constructed for Q3(a) to an equivalent PDA. You should strictly follow the construction we used in the class.

References

- [1] Sipser M.. Introduction to the Theory of Computation. CENGAGE Learning (2013)
- [2] Lewis H., Papadimitriou C.. Elements of the Theory of Computation. Prentice-Hall (1998)