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Int 201: Decision Computation and Language
Tutorial 7

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Question 1. Draw PDA for language $\{ww^R|w \in \{0,1\}^*\}$, where w^R is reversed of w, and show the language and L(PDA) (strings being accepted by PDA) are equivalent. [1]

Question 2. Can you draw PDA for language $\{ww|w \in \{0,1\}^*\}$? Can a PDA with two stacks recognize the language $\{ww|w \in \{0,1\}^*\}$? If the answer is yes for any of the questions, draw the PDA, no need for a proof. If the answer is no, give some intuitive explanation. (proof is better, but not necessary).

Question 3. Draw PDA P for language $L = \{a^i b^j c^k | i, j, k \geq 0, i = j \text{ or } j = k\}$, and show the $L = L(P)$. [2]

Question 4. Complete the proof for the Kleene closure property of CFL. In the sense, that the Kleen closure of language and the language being accepted by the constructed CFG grammar is the same set.

[1] Sets A and B being equivalent means $\forall x, x \in A \implies x \in B$ and $\forall x, x \in B \implies x \in A$
[2] Note that this is different from the pda in the lecture

Question 5 (Optional)**.** Given the CFG $G = (V, \Sigma, R, S)$:

- V = {S, NP,VP,Det,Nominal,Noun,PP,Preposition,Verb}
- Σ = The, spy, saw, cop, with, a , telescope
- Rules

  S $\rightarrow$ NP VP

  NP $\rightarrow$ Det Nominal

  Nominal$\rightarrow$ Noun $\|$ Nominal PP

  VP$\rightarrow$ VP PP$\|$ Verb NP

  PP $\rightarrow$ Preposition NP

  Det $\rightarrow$ The $\|$ a

  Noun $\rightarrow$ spy $\|$ cop$\|$telescope

  Verb $\rightarrow$ saw

  Preposition $\rightarrow$ with

Is there a third derivation other than what we found in the lecture for The spy saw a cop with a telescope ?

Question 6 (Optional)**.** Have fun with the notebook. https://github.com/ND-CSE-30151/spring-2024/blob/main/notes/12-pdas.ipynb