

Assignment 4

due Saturday, November 11, 2023

Please give a brief explanation of your answers.

1. Draw a PDA diagram for the following language

$$\{ w \in \{0, 1\}^* \mid \text{the length of } w \text{ is odd and its middle symbol is } 0 \}.$$

Draw the PDA directly - do not convert a grammar for the language to a PDA as you will do in exercise 3.

2. Draw a PDA diagram for the following:

$$\{ w\#x \mid w^{\mathcal{R}} \text{ is a substring of } x \text{ for } w, x \in \{0, 1\}^* \}.$$

As above, draw the PDA directly.

3. Convert grammar G_4 from exercise 2.1 (below) into a PDA following the method of the text.

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T \times F \mid F$$

$$F \rightarrow (E) \mid a$$

4. Convert the following CFG into an equivalent CFG in Chomsky normal form, using the procedure from the text:

$$A \rightarrow BAB \mid B \mid \epsilon$$

$$B \rightarrow 00 \mid \epsilon$$

Note: A is the start symbol

5. (*CS520 students only*) Give a counter-example to show that the following construction fails to prove that the class of context-free languages is closed under star. Let A be a CFL that is generate by the CFG $G = (V, \Sigma, R, S)$. Add the new rule $S \rightarrow SS$ and call the resulting grammar G' . This grammar is supposed to generate A^* .
6. (*CS520 students only*) Show that the class of context free languages is closed under the regular operations: union, concatenation, and star.