

CSE 3321 - Problem Set 4

Due beginning of lecture on October 8th

Collaboration is permitted; looking for solutions from external sources (books, the web, material from previous years, etc.) is prohibited.

1. Give a context-free grammar that generates the following language. The alphabet Σ is $\{0, 1\}$.

$$\{w : w \text{ starts and ends with the same symbol}\}$$

2. Give a context-free grammar that generates the following language. The alphabet Σ is $\{a, b\}$:

The complement of the language $\{a^n b^n : n \geq 0\}$.

3. Let $G = (V, \Sigma, R, S)$ be the following grammar. $V = \{S, T, U\}$; $\Sigma = \{0, \#\}$; and R is the set of rules:

$$S \rightarrow TT \mid U$$

$$T \rightarrow 0T \mid T0 \mid \#$$

$$U \rightarrow 0U00 \mid \#$$

- (a) Describe $L(G)$ (the language of G) in English.
 - (b) Prove that $L(G)$ is not regular.
4. Convert the following CFG into an equivalent CFG in Chomsky normal form.

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

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

5. Give an informal description and a state diagram of a pushdown automaton for the language:

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