Problem Set 3

CS 340 - Theory of Computation

14 September 2018

Problem 1. Give a context free grammar for the following context free languages:

- $L = \{w \in \{0,1\}^* \mid \#_0(w) > \#_1(w)\}$
- $L = \{w \in \{0,1\}^* \mid |w| \text{ is odd and middle symbol is } 0\}$

where for $j \in \{0,1\}$ and $w \in \Sigma^*$, $\#_j(w)$ denotes the number of occurrences of symbol j in the string w.

Problem 2. Give a context free grammar for the following context free language:

- $L = \left\{a^i b^j c^k \mid i = j \text{ or } j = k\right\}$
- $L = \left\{a^j b^k \mid j \leq k + 3\right\}$
- $L = \left\{a^j b^k c^l \mid l = j + k\right\}$

Problem 3. Consider the context free grammar $G = (N, \Sigma, P, S)$ where $N = \{S\}$, $\Sigma = \{a, b\}$ and P is defined as follows:

$$S \to aSbS \mid bSaS \mid \epsilon$$

Describe $L(G)$ and give a formal proof justifying your answer.