

Homework 3 – due Tuesday, Feb. 8

Problem 1 Give context-free grammars that generate the following languages over the alphabet $\{0, 1\}$:

(a) $\{w \in \{0, 1\}^* \mid w \text{ contains more 1's than 0's}\}$

(b) $\{0^n 1^m \mid n + m \text{ is odd}\}$.

(c) $\{w \in \{0, 1\}^* \mid w \neq w^R\}$

Problem 2 Convert the following CFG into an equivalent CFG in Chomsky normal form (the start variable is S):

$$\begin{aligned} S &\rightarrow aSbb \mid T \\ T &\rightarrow bTaa \mid S \mid \varepsilon \end{aligned}$$

Problem 3 Prove that the language $\{1^p \mid p \text{ is a prime number}\}$ is not context-free.

Problem 4 Problem 2.2, page 120 of *Sipser*.

Problem 5 Problem 2.15, page 121 of *Sipser*.

Problem 6 Problem 2.17 (b), page 121 of *Sipser* (assume part (a) to be true).