

Handout 4: Problem Set 4

*Instructor: John Hopcroft**Teaching Assistant: Zhengyang Liu, Tao Xiao***Due by Friday, Dec 20th, 8pm.**

1 Let $G = (\{S, A, B\}, \{a, b\}, \{S \rightarrow bA|aB, A \rightarrow a|aS|bAA, B \rightarrow b|bS|aBB\}, S)$ be a context-free grammar. Give a rigorous proof that $L(G)$ is the set of all strings of a 's and b 's with an equal number of a 's and b 's.

2 Use h, h^{-1} and $\cap R$ to replace every copy of 001 in each string in L by 0. For example:

$$00101 \rightarrow 001 \text{ and } 110010001 \rightarrow 11000$$

3 Use the pumping lemma to prove

$$\{a^i b^j c^k \mid i \leq j \leq k\}$$

not context free.

4 Use the pumping lemma to prove

$$\{a^j b^j c^j \mid i \leq j \leq 2i\}$$

not context free.

5 By any method prove

$$\{ww^R w \mid w \in (a+b)^*\}$$

not context free.