

COMP3721 Tutorial 6

1 Pumping Theorem for CFL

1. For each of the following languages L , state whether L is contextfree or not and justify your answer. If context free show a PDA or CFG, if not apply Pumping Lemma for CFL.
 - (a) $\{a^i b^j c^k : i + j = k, i, j, k \geq 0\}$
 - (b) $\{a^i b^i c^{2i} : i \geq 0\}$
 - (c) $\{a^i b^j c^i d^j : i, j \geq 0\}$
 - (d) $\{a^i b^j c^j d^i : i, j \geq 0\}$

2 Closure Property for CFL

1. Use closure property of CFG to show that the following languages are context-free.
 - (a) $\{a^i b^j : i \neq j\}$
 - (b) $\{xx^R yy^R zz^R : x, y, z \in \{a, b\}^*\}$
 - (c) $L - R$, where L is context-free and R is regular.