CMPE 350 - Summer 2014
PS#4

18.07.14

Chapter 2

2.15 Convert the following CFG into an equivalent CFG in Chomsky normal form.

$$A \to BAB|B|\epsilon$$
$$B \to 00|\epsilon$$

2.18 a) Let C be a context-free language and R be a regular language. Prove that the language $C \cap R$ is context-free.

b) Use part a) to show that the language $A = \{w|w \in \{a, b, c\}^*$ and contains equal number of a's, b's and c's$\}$ is not a CFL.

- a) Show that the following language is context-free: $\{w\#x|w^R$ is a substring of x for $w, x \in \{0, 1\}^*\}$.

  b) Show that the following language is not context-free: $\{w\#x|w$ is a substring of x for $w, x \in \{0, 1\}^*\}$.

2.30 Use the pumping lemma to show that the following languages are not context-free.

a) $\{0^n 1^n 0^n 1^n | n \geq 0\}$

d) $\{t_1\#t_2\# \ldots \#t_k | k \geq 2$, each $t_i \in \{a, b\}^*$ and $t_i = t_j$ for some $i \neq j\}$

2.26 Show that if G is a CFG in Chomsky normal form, then for any string $w \in L(G)$ of length $n \geq 1$, exactly $2n - 1$ steps are required for any derivation of w.

2.35 Let G be a CFG in Chomsky normal form that contains b variables. Show that if G generates some string with a derivation at least 2^b steps, $L(G)$ is infinite.

- Show that context-free languages are **not** closed under complementation and intersection.
- Give two context-free languages which have the following properties: Both L_1 and L_2 are non-context-free, and $L_1 \cap L_2$ is regular.