Homework #7

#1. (10 points) True/ False

a. The Pumping Lemma for CFL's can be used to show a language is context-free
True False

b. The string $z = a^k b^{k+1} c^k$ can be used to show $\{a^n b^n c^n\}$ is not context free
True False

c. The string $z = a^k a^k a^k$ can be used to show $\{w\, w^R w \mid w \in \{a,b\}^*\}$ is not context-free
True False

d. Given a CFG, G, and a string w, it is decidable whether $w \in L(G)$ True False

e. The intersection of a context-free language and a regular language is context-free
True False

#2. (5 points) Why must we remove the recursive Start to convert to Chomsky Normal form?

#3. (5 points) What is the relationship between the length of a string and the length of its derivation if the grammar is in Greibach normal Form?

#4. (20 points) Convert the following grammar to Chomsky Normal Form. Show work clearly.

$$S \rightarrow aSb \mid BB \mid BCD \mid ab \mid BC$$
$$A \rightarrow B \mid DD \mid BCB \mid D \mid \lambda$$
$$B \rightarrow AB \mid C$$
$$C \rightarrow Cc \mid c$$
$$D \rightarrow Scc \mid cc$$

#5. (10 points) Show the following languages are or are not context-free:

a) $\{a^i b^j c^m \mid i \neq j \neq m;\ i,j,k \geq 0\}$

b) $\{a^i b^j c^m \mid i < j < m;\ i,j,k \geq 0\}$