CS 373 Fall 2010
Quiz 6 Solutions

Lecture 1 — Mahesh

1. C. For a grammar in Chomsky Normal Form, the number of steps in any derivation of a string w is $2|w| - 1$ (see problem 2.26 assigned as practice problem).
2. A. When proving that a language does not satisfy the pumping lemma we need consider all possible ways of dividing a chosen long string.
3. C. Observe that even though have proved that L satisfies the pumping lemma it is not context-free.
4. A. In fact, L_{eq} is not context-free.
5. C. Observe that if L_1 is Σ^* then $L_1 \oplus L_2 = \overline{L_2}$ which may or may not be context-free. But no matter what since L_1 and L_2 are both decidable, and decidable languages are closed under all Boolean operations, $L_1 \oplus L_2 = (L_1 \cap \overline{L_2}) \cup (L_2 \cap \overline{L_1})$ is decidable.
6. C. If L is taken to be $\{a^n b^n \mid n \geq 0\}$ then both L and $\overline{L}$ are context-free. On the other hand, if $L = \{ww \mid w \in \Sigma^*\}$ then L is not context-free, while $\overline{L}$ is context-free.

Lecture 2 — Gul

1. A. For a grammar in Chomsky Normal Form, the number of steps in any derivation of a string w is $2|w| - 1$ (see problem 2.26 assigned as practice problem).
2. B. When proving that a language satisfies the pumping lemma we need consider all possible long string z.
3. A. When proving that a language does not satisfy the pumping lemma we need consider all possible ways of dividing a chosen long string.
4. C. Follows from the fact that context-free languages are closed under all the operations used in the proof and $\{b^n c^n d^n \mid n \geq 0\}$ is non-context-free.
5. C. One can easily come up with a grammar for L^R; we simply reverse the right hand side of every rule in the grammar for L.
6. C. If you take $L_2 = \{ww \mid w \in \Sigma^*\}$ and $L_1 = \overline{L_2}$ then $L_1 \cup L_2 = \Sigma^*$ which is clearly context-free. On the other hand, if you take $L_1 = \emptyset$, then $L_1 \cup L_2 = L_2$ which is not context-free.