Homework 7

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3.5.1 (a)

We can write $\{a^m b^n : m \neq n\}$ as the union of the following two context-free languages: $\{a^m b^n : m > n\} \cup \{a^m b^n : m < n\}$.

2

So we take our language L and intersect it with the language $a^* c a^* c a^*$, if L is context free we know that this intersection should also be context free. However, a string of the form $a^n c a^n c a^n$ is in the intersection of the two languages and we know, in applying the pumping lemma, that no choice of v and y can result in a string that is in the language because choosing v and y to be the two c's in the language will obviously lead to a string that is not in the language because the string must contain exactly two c's, and one may not choose v and y to contain any a's because doing so will result in an unequal number of a's on the remaining side of the c's (that is, you cannot pump all three a's; only two of them) and so we must conclude that any pumped string would not be in the intersection . Therefore, because the pumped string is not in the intersection this implies that the intersection is not context free which implies that L is not context free.

3.

We know that $\{a^m b a^n b a^p : m = n \text{ or } n = p \text{ or } m = p\}$ is context-free because it can be written as the union of the following three context-free languages: $\{a^m b a^n b a^p : m = n\} \cup \{a^m b a^n b a^p : m = p\} \cup \{a^m b a^n b a^p : n = p\}$