COSC 3340: 2012 Final Questions (No solutions)

1. Construct a regular expression over {a, b, c} for the language accepted by this nfa:

	a	*b*	*c*	
-> *A*	/	A, B	/	0
B	B	/	C	1
C	/	A, B	/	1

2. Prove that the language L(G) is not regular where G is the following cfg:
   G = ({S, A, B}, {a, b}, {S->Abb|B, A->bS, B->a}, S).
   Note: You must first determine L(G).

3. Construct a reduced dfa over {0,1}:

   $\overline{\quad\quad}$
   [(10*)* ∩ 1*01*]
   Note: You must first determine nfas for (10*)* and 1*01*, than do the intersection. The answer must then be reduced.

4. Construct a Chomsky normal form grammar for L(G) for the following cfg G:
   G = ({S, B}, {a, b, c, d}, {S->Sb|Ba, B->cBdd|S|ε}, S).
   Note: You must first remove all ε- and all unit productions.

5. Construct a Greibach normal form grammar for L(G) for the following CNF G:
   G = ({S, A}, {a, b}, {S->AS|A, A->SA|aba}, S).
   Note: You must first remove all unit productions. You must derive all the productions for S and A; indicate how the result looks for S' and A'.

6. Prove that the following language L is not contextfree: L = $\{0^n\ 1^{n+1}\ 0^n \mid n>0\}$

7. Consider the class $\mathbf{REG_A}$ of all contextfree language over the fixed alphabet A.
   a. Is $\mathbf{REG_A}$ countable?
   b. Is the class $\mathbf{NOTREG_A}$ countable where $\mathbf{NOTREG_A}$ consists of all languages over A that are not contextfree?
   c. Is the class $\mathbf{REG_A} \cap \mathbf{NOTREG_A}$ countable?

8. Construct a Turing machine for the language in Question 6, L = $\{0^n\ 1^{n+1}\ 0^n \mid n>0\}$.
   Note: Describe first the process in English; then translate this into moves of Turing machine.

9. Let L1 and L2 be arbitrary languages, subject to the specification in either (i) or (ii).
   Consider the following four questions:
   (Q1) Does $\mathbf{L_2 - L_1}$ contain a given fixed word w? (Q2) Is $\mathbf{L_2 - L_1}$ empty?
   (Q1) Does $\mathbf{L_1 \cap L_2}$ contain a given fixed word w? (Q2) Is $\mathbf{L_1 \cap L_2}$ empty?
   For each of these four questions **explain with reasons** whether the problem is recursive, not recursive but r. e., or non-r. e.. provided
   (i) Both are recursive. (ii) $\mathbf{L_1}$ is r. e. but not recursive and $\mathbf{L_2}$ is recursive.