COSC 3340/6309 Final Examination

Wednesday, July 6, 2011, 2 – 5 pm

Open Book and Notes Final grades only through PeopleSoft

YOU MUST USE THE CONSTRUCTIONS GIVEN IN CLASS

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

	a	b	c	
→ A	/	A,C	/	0
B	B	/	A	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→Aa|B, A→aaS, B→b}, S).

Note: You must first determine L(G).

3. Construct a reduced dfa for the following extended regular expression over {0,1}:

$$\left[\overline{(10^*)^*} \cap\ 1^*01^*\right]$$

Note: You must first determine nfas for (10*)* and 1*0, then 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 CFL_A of all contextfree languages over the fixed alphabet A.

(a) Is CFL_A countable?

(b) Is the class $NOTCFL_A$ countable where $NOTCFL_A$ consists of all languages over A that are not contextfree?

(c) Is the class $CFL_A \cap NOTCFL_A$ countable?

For each question, you must give a precise argument substantiating your answer.

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 the Turing machine.

9. Let L_1 and L_2 be arbitrary languages, subject to the specification in either (i) or (ii). Consider the following four questions:

(Q1) Does $L_2 - L_1$ contain a given fixed word w? (Q2) Is $L_2 - L_1$ empty?

(Q3) Does $L_1 \cap L_2$ contain a given fixed word w? (Q4) Is $L_1 \cap L_2$ empty?

For each of these four questions **explain with reasons** whether the general problem is recursive, not recursive but r. e., or non-r. e., provided

(i) Both L_1 and L_2 are recursive.

(ii) L_2 is r. e., but not recursive and L_1 is recursive.

Note that there are **eight** different questions to be answered.