Computer Science
Comprehensive Examination
Formal Languages
Fall 2001

1) (20 points) For each of the following indicate whether the specified language is (a) regular, (b) context-free but not regular, (c) recursive but not context-free, or (d) non-recursive (note that no proof is required in any case).

a) $\{0^i \mid i>=0\}$

b) $\{0^i 1^i \mid i>=0\}$

c) $\{0^i 1^i 2^i \mid i>=0\}$

d) $\{0^i 1^i 2^i 3^i \mid i>=0\}$

2) (15 points) Suppose *L* is a finite language, i.e., contains a finite number of strings over some finite alphabet. For each of the following, be sure to explain your answer.

a) Is *L* guaranteed to be regular?

b) Is *L* guaranteed to be context-free?

c) Is *L* guaranteed to be recursive?

3) (15 points) Explain one technique for showing that a language **is** context-free. Stated another way, suppose you are given a language *L*. How do you show that *L* is context-free?

4) (15 points) Explain one technique for showing that a language **is** recursive. Stated another way, suppose you are given a language *L*. How do you show that *L* is recursive?

5) (20 points) State the pumping lemma for regular languages.

6) (15 points) Give a DFA or NFA that accepts the language 0*1*(0+11)*. Note that for this question you are not required to perform a formal conversion using any particular technique. Simply giving the DFA or NFA is sufficient.