Theory of computation Final Review Fall 2005

1. On the midterm the following question is presented

Use the pumping lemma to show that the following language is not regular.
Assume Σ={a,c}. C={$a^n c^{2n}$ | n,m > 0} this language has two c's for each a.
Show that the this language is a CFL.

2. The textbook states that we cannot tell if a CFL is Σ* but we can tell if it is empty. Explain the proofs of both of these results.
    a. We can design a Turing machine to Decide whether a CFL presented as a grammar is empty.
    b. We cannot design a Turing machine to Decide whether a CFL presented as a grammar is the set of all strings Σ*.

3. Design a DFA that has input set Σ={0,1} and accepts the language {0^n | n>0}
4. Design a CFG that has alphabet Σ={0,1} and generates the language {0^n | n>0}.
5. Design a Turing Machine TM that has input set Σ={0,1} and accepts the language {0^n}.

6. Show that a two stack PDA is more powerful than a one stack PDA.
7. Show that a two stack PDA is not more powerful than a two stack PDA.

8. Explain the difference between TM Decidable and Enumerable.
9. Why is the Halting Problem not Decidable?
10. Why is the Halting Problem Enumerable
11. Why is the complement of the Halting Problem not Enumerable.

12. Are the following true or false. Justify your answer.
    a. $5n^3 + 3n = O(n^2)$
    b. $n^{10}n^{10} = O(n^{1000})$
    c. $2^n + n\log n = O(n^2)$
    d. $n^{10} + n^{10} = O(n^{10})$
    e. $(n+n\log n)^2 = O(n^2)$
    f. $10^{1000}n = O(n)$
    g. $n^n = O(n)$