CS4280, Fall 2009, Test 1

Time 75min. Open notes. Use extra paper as needed, but make sure to identify each question and subquestion otherwise no credit. All questions are equal.

YOU MUST RETURN THIS PAGE. NAME_____

1 a) Write formal expression for a language that uses ternary digits {0,1,2}, and valid sentences start with optional 0, then follow with at most two 2s, then exactly one 1, and terminate with at least one 0. Use either notation.
   b) How many valid strings we have?
   c) How many valid strings we have up to length 5? Write them.

2 Assuming the same ternary alphabet, a language uses the following lexical definitions: tokenA is anything starting with 0, tokenB is anything else but shorter than 4 characters total, tokenC for anything else (all token must use the alphabet only).
   If DFSA can be designed to recognize the tokens, produce one, else state why it cannot be done.

3 A vending machine takes 10s and 5s. It has no other buttons. If you insert exactly 15, you get small cookie. If you insert 25 or more, you get big cookie and change. Your task is to design DFSA to operate the machine, assuming a money slot is functional and tells you what has been inserted.
   a) What is the alphabet?
   b) What are the tokens?
   c) Design DFSA.

4 You have a C compiler for machine M1, source and binary. You bought machine M2, different machine language. No one sells C compilers for M2 so you have to do all the work.
   a) Show how to build a compiler, with minimum efforts, on M1 that would generate code for M2 but run on M1.
   b) Show step by step what would happen to a C program from when written until when executed on M2.
   c) M1 is to be retired so you decided to put an interpreter on M2 to run the M1 compiler. Show all steps to develop that.

5 Write BNF for expressions using logical operators OR AND and NOT. Precedence and associativity should be standard. Parenthesis are allowed. Valid sentence is atomic token tkB, or any combination of valid sentences connected by () and operators.

6 Now write a BNF (do not use extensions) for programs which are use the above expressions (do not define them again). A valid procedure is a sequence of expressions (at least one) separated by ";"and enclosed within BEGIN/END block. A valid program is a sequence of expressions and procedures, starts with START and ends with STOP.

7   Why are interpreters
    a) easier to write than compilers
    b) considered slower than compilers

8   You have a compiler for some language, source and binary, on a given machine. You
    want to improve execution efficiency of the generated targets. Explain what needs to
    be done with minimal efforts, to the compiler.