CSE 105: Introduction to the Theory of Computation, Fall 1999
HW1 Due Tuesday, Oct 19, at the beginning of class

Finite Automata, Regular Expressions, and Regular Languages

1. For the following languages, give both state diagrams of NFA's and regular expressions that recognize the following languages over the alphabet { **0 1** }.
   (a) { w | w contains at least three **1**'s or an even number of **0**'s}
   (b) { w | w does not contain **001** as a substring }
   (c) { w | w contains the substring **0101** } (Your NFA should have five states.)
2. Problem 1.6(a) in text.
3. Problem 1.7(a) in text. Closure under concat. of FA
4. Problem 1.10 in text.
5. Problem 1.12(a) in text. Your DFA should have the minimal number of states.
6. Problem 1.16(b) in text: Write a regular expression for the language of the FA.
7. Problem 1.17(a) in text.
8. Problem 1.24 in text.
9. Problem 1.25 in text.
10. The language of *balanced parentheses* over { **( )** } is defined as follows:
    - The empty string is balanced.
    - The string **()** is balanced.
    - If s1 and s2 are balanced, then so are s1s2 and **(**s1**)**.

    Show that the language of balanced parentheses is not regular.
11. Write a regular expression to describe *Java integer variable declarations*. A Java integer variable declaration consists of an optional variable modifier part, a type, and a variable declarator part. A variable modifer part is one of the keywords **public protected private static final transient volatile**. The type is one of the keywords **byte short int long**. A variable declarator part is a Java identifier (covered in class). (You may treat keywords used in your expression as symbols in your regular expression, distinct from letters used in identifers.)
12. You can prove that 2 regular expressions are equivalent (describe the same languages) by showing that their minimal state DFA's are the same, except for names. Show that the following two regular expressions are equivalent using this technique: $(a \cup b)^*$ and $(a^* \cup b^*)^*$.