CS 536 — Spring 1998

Homework #1

Due: Thursday, March 19, 1998
Not accepted after class on March 25, 1998

#1 Write a regular expression that defines a C-like comment delimited by /∗ and ∗/. Individual ∗'s and /'s may appear in the comment body, but the pair ∗/ may not.

#2 Write a finite automaton that accepts non-empty strings of a's, b's, and c's with the property that if a particular character appears in the string, it must appear an *even* number of times. The following strings are allowed: aa, aabb, bbbbcc, and bcababbc. The following strings are not allowed: a, cbb, bbba, bbcbb, and λ.

#3 Show an NFA that corresponds to the following regular expression:

$$(ab \mid aba \mid b)^+$$

Using MakeDeterministic (p 82), translate the NFA into a DFA.
Optimize this DFA using the techniques of §3.6.2.

#4 Show the DFA that corresponds to the following regular expression:

$$(0 \mid 1)^* \; 0 \; (0 \mid 1) \; (0 \mid 1) \; (0 \mid 1)$$

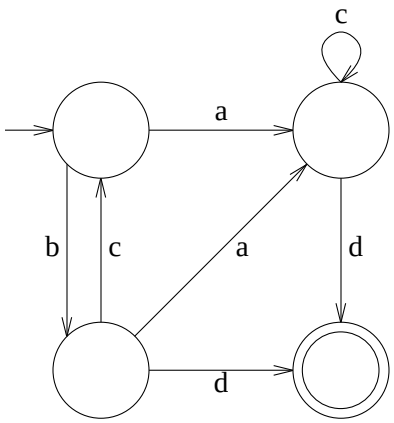
How many states does your DFA contain?
Show that, in general, if the above regular expression ends in n repeated (0 | 1) terms (rather than 3) then the corresponding DFA *must have* at least 2^n states.

#5 Is the set of binary strings (over 0 and 1) that represent even positive integers a regular set? Why? Is the set of binary strings (over 0 and 1) that represent positive integers evenly divisible by 3 a regular set? Why?

#6 Let s be a string. Define insert(s) to be the function that inserts a # into each possible position in s. If s is n characters long, insert(s) returns a set of n+1 strings (since there are n+1 places a # may be inserted in a string of length n).

For example, insert(abc) = {#abc, a#bc, ab#c, abc#}. insert applied to a set of strings is the union of insert applied to members of the set. Thus insert(ab, de) = {#ab, a#b, ab#, #de, d#e, de#}.

Let R be any regular set (my choice). Show that insert(R) is a regular set.

Hint—Given a finite automaton for R, construct one for insert(R).

#7 What regular expression does the following NFA correspond to? Explain how you obtained your answer.