CS109B Problem Set #3
Due 4:30 PM, Friday 4/28/95

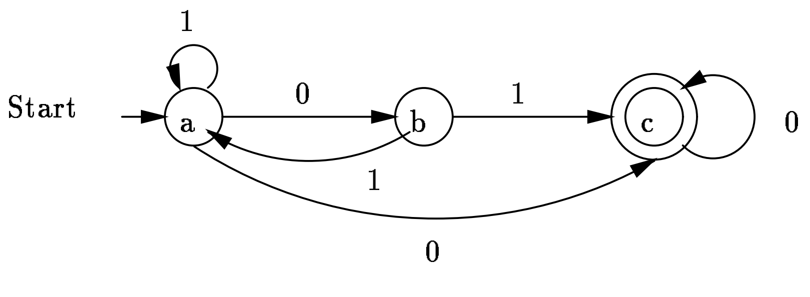
Note: We plan to distribute solutions in class on 4/28, so you can have them for the exam on 5/1. Since the problem set may be handed in until 4:30PM, I assume those wishing to avail themselves of the last hour to work on the set will refrain from picking up solutions in class. They will be available at the handout hangout near Ms. Winkler's office, where assignments are turned in.

1) (15 points) We can generalize the graph of Fig. 9.64 to have a central node and k nodes in a ring, each node connected only to its neighbors around the ring and to the central node. As a function of k, what is the chromatic number of this graph? Justify your answer. (Exercise 9.10.6, FCS).

2) (15 points) Design an automaton that tells whether a character string is a legal C identifier (letter followed by letters, digits, or underscore) followed by a blank. (Exercise 10.2.4, FCS)

3) (15 points) Design an automaton that reads a word (character string) and tells whether the letters of the word are in sorted order. For example, `adept` and `chilly` have their letters in sorted order; `baby` does not, because an `a` follows the first `b`. The word must be terminated by a blank, so that the automaton will know when it has read all the characters. (Unlike Example 10.1, here we must not accept until we have seen all the characters, that is, until we reach the blank at the end of the word.) How many states do you need? What are their intuitive meanings? How many transitions are there out of each state? How many accepting states are there? *Note*: Since this automaton has many states, it is sufficient to describe it rather than drawing its graph. (Exercise 10.2.3, FCS)

4) (15 points) Convert the following NFA to an equivalent DFA.



5) (10 points) Write a regular expression for the set of strings of a's and b's such that there are no two consecutive a's and no two consecutive b's.

6) (10 points) Prove that $(R \mid R*) \equiv R*$. The simplest proof is to show containment of sets in both directions. (Exercise 10.7.4(a), FCS)

7) (10 points) Define a datatype that enumerates the twelve months. Then write a case expression that produces the number of days of a given month. Assume February always has 28 days. You may use suitable abbreviations for the months, such as `Jan`.

(Exercise 19.2, EMLP)

8) (10 points) Suppose we have a list L of items with the record structure introduced in Example 18.1 of EMLP (p. 194). Write a function that, given a list L and an ID i, finds the list of courses in the first (and presumably only) record with `ID` field equal to i. (Exercise 18.2(b), EMLP)