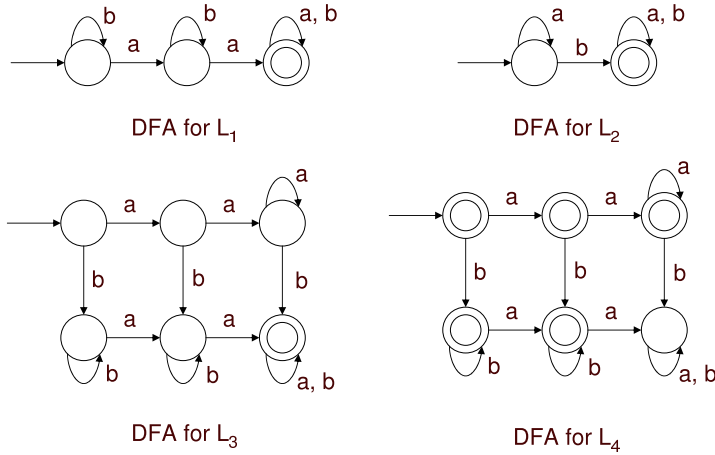


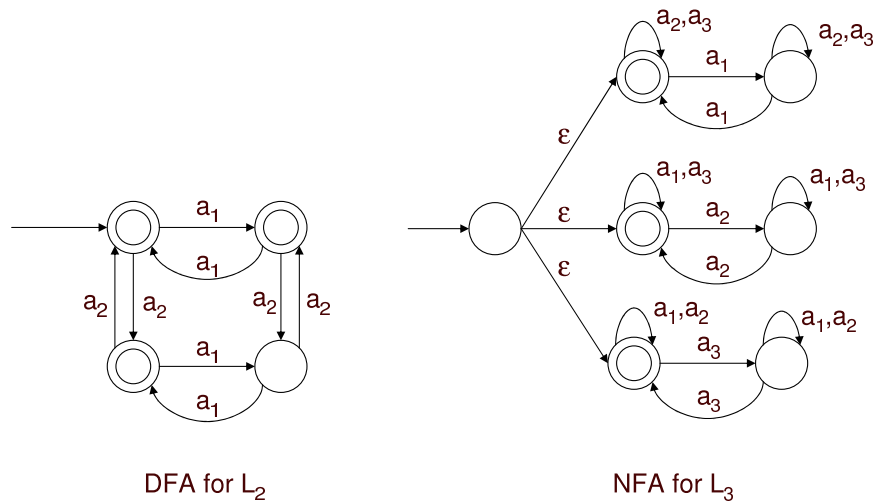
Solutions to Written Assignment 1

1.



2. The language recognized by the DFA is the set of all strings in which the number of a's is $2 \pmod 3$. A regular expression that represents such a language is $b^*ab^*a(b^*ab^*ab^*a)^*b^*$.

3.



4. (a) • L_1 : It is not regular since for any string the DFA needs to record the difference of the number of 1's and 0's that it has seen so far. Every DFA has a finite number number of states; hence for every DFA, there will exist large enough strings for which the DFA cannot keep track of this difference.

All strings over the alphabet $\{0, 1\}$ that have equal number of 1's and 0's.

• L_2 : It is not regular since for any string the DFA needs to record the first half of the string (so that the DFA can appropriately match it with the later half). Every DFA has a finite number number of states; hence for every DFA, there will exist large enough strings for which the DFA cannot keep track of the first half of the string.

• L_3 : It is regular since it contains finitely many strings.

- (b) Cool expression language is not regular because the parentheses in the Cool expressions must be balanced (and we know that the language of balanced parenthesis is not regular). Another reason is that the keyword “if” in the Cool expression language must have a matching “fi”.