Exercise 3.7.

Find a regular expression corresponding to each of the following subsets of $\{a, b\}^*$.

a. The language of all strings containing exactly two a's.

c. The language of all strings that do not end with ab.

e. The language of all strings not containing the substring aa.

f. The language of all strings in which the number of a's is even.

g. The language of all strings containing no more than one occurrence of the string aa. (The string aaa should be viewed as containing two occurrences of aa.)

Exercise 3.7.

Find a regular expression corresponding to each of the following subsets of $\{a, b\}^*$.

i. The language of all strings containing both bb and aba as substrings.

j. The language of all strings not containing the substring aaa.

k. The language of all strings not containing the substring bba.

l. The language of all strings containing both aba and bab as substrings.

m. The language of all strings in which the number of a's is even and the number of b's is odd.

Exercise 3.1. In each case below, find a string of minimum length in $\{a, b\}^*$ not in the language corresponding to the given regular expression.

a. $b^*(ab)^*a^*$
b. $(a^* + b^*)(a^* + b^*)(a^* + b^*)$

Exercise 3.2. Consider the two regular expressions

$$r = a^* + b^* \qquad s = ab^* + ba^* + b^*a + (a^*b)^*$$

a. Find a string corresponding to r but not to s.
b. Find a string corresponding to s but not to r.
c. Find a string corresponding to both r and s.
d. Find a string in $\{a, b\}^*$ corresponding to neither r nor s.

Exercise 3.10.

a. If L is the language corresponding to the regular expression $(aab + bbaba)^*baba$, find a regular expression corresponding to $L^r = \{x^r \ \mid \ x \in L\}$.

b. Using the example in part (a) as a model, give a recursive definition (based on Definition 3.1) of the reverse e^r of a regular expression e.

c. Show that for every regular expression e, if the language L corresponds to e, then L^r corresponds to e^r.

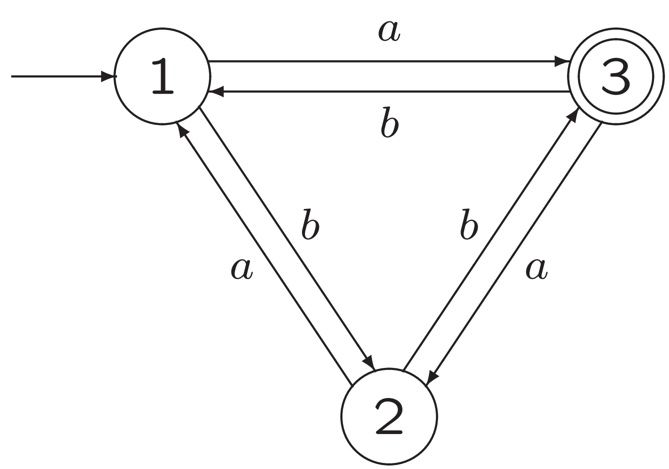
Exercise 3.41. For each of the following regular expressions, draw an NFA accepting the corresponding language, so that there is a recognizable correspondence between the regular expression and the transition diagram.

e. $(a^*bb)^* + bb^*a^*$

Exercise 3.42. For part (e) of Exercise 3.41, draw the NFA that is obtained by a literal application of Kleene's theorem, without any simplifications.

Exercise 3.51.
Use the algorithm of Theorem 3.30 to find a regular expression corresponding to the FA below.
Start by constructing (complete) tables showing $r^k(i,j)$ for each k with $0 \le k \le 2$.
Finish up with $r^3(q_0,q)$ for every $q \in A$, i.e., with $r^3(1,3)$.

a.



Exercise 3.51 (variant).
Use the algorithm of Brzozowski and McCluskey to find a regular expression corresponding to the FA below.

a.