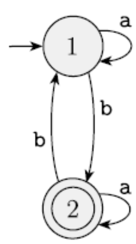
Tutorial problems on Regular Expressions

From Sipser's book –

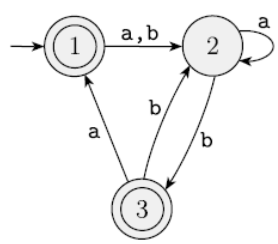
1.20 For each of the following languages, give two strings that are members and two strings that are *not* members—a total of four strings for each part. Assume the alphabet $\Sigma = \{a,b\}$ in all parts.

a. a^*b^*
b. $a(ba)^*b$
c. $a^* \cup b^*$
d. $(aaa)^*$
e. $\Sigma^* a \Sigma^* b \Sigma^* a \Sigma^*$
f. $aba \cup bab$
g. $(\varepsilon \cup a)b$
h. $(a \cup ba \cup bb)\Sigma^*$

1.21 Use the procedure described in Lemma 1.60 to convert the following finite automata to regular expressions.



(a)



(b)

1.28 Convert the following regular expressions to NFAs ·
In all parts, $\Sigma = \{a, b\}$.

a. $a(abb)^* \cup b$
b. $a^+ \cup (ab)^+$
c. $(a \cup b^+)a^+b^+$

From Ullman's book –

3.4.8 Exercises for Section 3.4

Exercise 3.4.1: Verify the following identities involving regular expressions.

* a) $R + S = S + R$.

  b) $(R + S) + T = R + (S + T)$.

  c) $(RS)T = R(ST)$.

  d) $R(S + T) = RS + RT$.

  e) $(R + S)T = RT + ST$.

* f) $(R^*)^* = R^*$.

  g) $(\epsilon + R)^* = R^*$.

  h) $(R^*S^*)^* = (R + S)^*$.

! **Exercise 3.4.2:** Prove or disprove each of the following statements about regular expressions.

* a) $(R + S)^* = R^* + S^*$.

  b) $(RS + R)^*R = R(SR + R)^*$.

* c) $(RS + R)^*RS = (RR^*S)^*$.

  d) $(R + S)^*S = (R^*S)^*$.

  e) $S(RS + S)^*R = RR^*S(RR^*S)^*$.