

Assignment 2

Due date: February 11, 2013, by 11:59 a.m. EST

1. Consider the following ϵ -NFA.

	ϵ	a	b	c
$\rightarrow \star p$	$\{q, r\}$	\emptyset	$\{q\}$	$\{r\}$
q	\emptyset	$\{p\}$	$\{r\}$	$\{p, q\}$
$\star r$	\emptyset	\emptyset	\emptyset	\emptyset

- (a) Convert the ϵ -NFA to an NFA.
 (b) Convert your NFA from (a) to a DFA.
2. Consider the two regular expressions

$$R = 0^* + 1^*$$

$$S = 01^* + 10^* + 1^*0 + (0^*1)^*$$

- (a) Find a string in $L(R) \setminus L(S)$.
 (b) Find a string in $L(S) \setminus L(R)$.
 (c) Find a string in $L(R) \cap L(S)$.
 (d) Find a string in $\overline{L(R) \cup L(S)}$.
3. Give a regular expression for each of the languages below.
- (a) $\{aa, ab, ba, bb\} \setminus \{aa, bb\}$.
 (b) $\{a^k b^m c^n : k + m + n \text{ is odd}\}$.
 (c) $\{w \in \{a, b, c\}^* : \text{no symbol occurs twice in succession in } w\}$.
 (d) $\{w \in \{0, 1\}^* : 00 \text{ occurs at most twice in } w\}$.
Note: 00 occurs twice in 000

4. Use the state-elimination technique to find a regular expression for

- (a) the DFA given by the following transition table:

	0	1
$\rightarrow \star q_0$	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
q_3	q_1	q_2

- (b) the DFA given by the following transition table:

	a	b	c
$\rightarrow q_1$	q_6	q_2	q_4
q_2	q_3	q_6	q_6
q_3	q_4	q_5	q_6
q_4	q_2	q_6	q_5
$\star q_5$	q_6	q_6	q_6
q_6	q_6	q_6	q_6

5. Convert the following regular expressions to ϵ -NFA's.

- (a) $(000)^*(\epsilon + 011 + 001)(111)^*$
 (b) $(0 + 1)^*(001 + 010 + 100)^*(0 + 1)^*$
 (c) $(01 + 10)^* + (00 + 11)^* + (1 + 10 + 100)^*$

6. For each of the following, if the statement is true for all languages L and M then prove it; otherwise give a counterexample.

- (a) $(L + M)^* = (L^*M)^*$
 (b) $(LM + L)^*L = L(ML + L)^*$
 (c) $L^*(M(M^* + L^*)L)M^* = (L + ML + MML)^*M^*$

7. Apply the Pumping Lemma to prove that the following languages are not regular.

- (a) $\{a^k b^n : n = 2^k\}$
 (b) $\{w \in \{a, b\}^* : w^R = w\}$
 (c) $\{vw : v \in \{a, b\}^*, w \in \{c, d\}^*, |v| = |w|\}$