

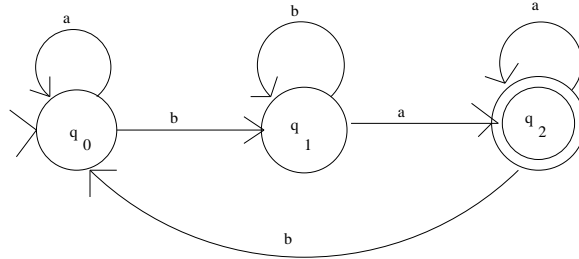
CS 3133 Foundations of Computer Science
C term 2018

Solutions for Homework 3

1. Exercise 1 on page 184.

Solution:

(a) The state diagram of M is



(b)

i) $[q_0, abaa]$
 $\vdash [q_0, baa]$
 $\vdash [q_1, aa]$
 $\vdash [q_2, a]$
 $\vdash [q_2, \lambda]$

ii) $[q_0, bbbabb]$
 $\vdash [q_1, bbabb]$
 $\vdash [q_1, babbb]$
 $\vdash [q_1, abb]$
 $\vdash [q_2, bb]$
 $\vdash [q_0, b]$
 $\vdash [q_1, \lambda]$

iii) $[q_0, bababa]$
 $\vdash [q_1, ababa]$
 $\vdash [q_2, baba]$
 $\vdash [q_0, aba]$
 $\vdash [q_0, ba]$
 $\vdash [q_1, a]$
 $\vdash [q_2, \lambda]$

iv) $[q_0, bbbaa]$
 $\vdash [q_1, bbbaa]$
 $\vdash [q_1, baa]$
 $\vdash [q_1, aa]$
 $\vdash [q_2, a]$
 $\vdash [q_2, \lambda]$

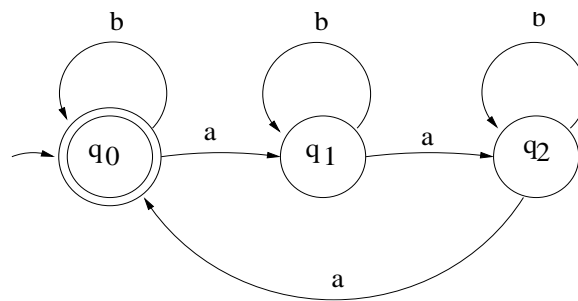
(c) The computations in *i*, *iii* and *iv* terminate in the accepting state q_2 . Therefore the strings $abaa$, $bababa$ and $bbbaa$ are in $L(M)$.

(d) Two regular expressions describing $L(M)$ are $\mathbf{a^*b^+a^+(ba^*b^+a^+)^*}$ and $\mathbf{(a^*b^+a^+b)^*a^*b^+a^+}$. (20 points)

2. Exercise 11 on page 185.

Solution:

The state diagram of a DFA is

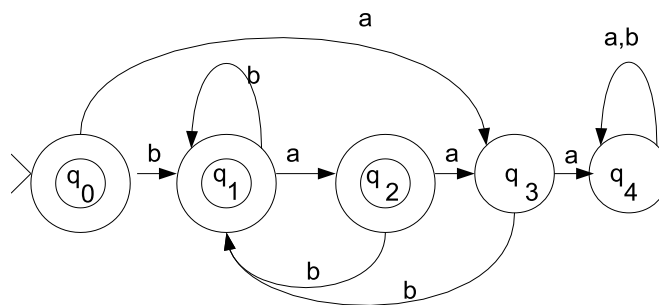


(20 points)

3. Exercise 12 on page 185.

Solution:

The state diagram of a DFA is



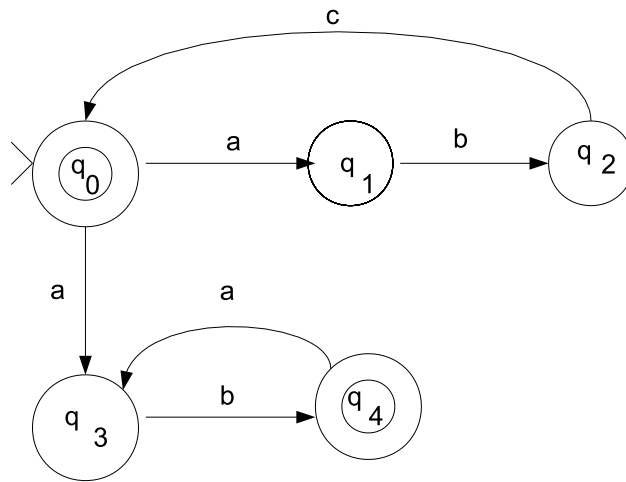
(20 points)

4. Design an NFA that accepts the following language over the alphabet $\{a, b\}$:

$$(abc)^*(ab)^*$$

Solution:

The state diagram of an NFA is



(20 points)

5. Exercise 36 on page 187.

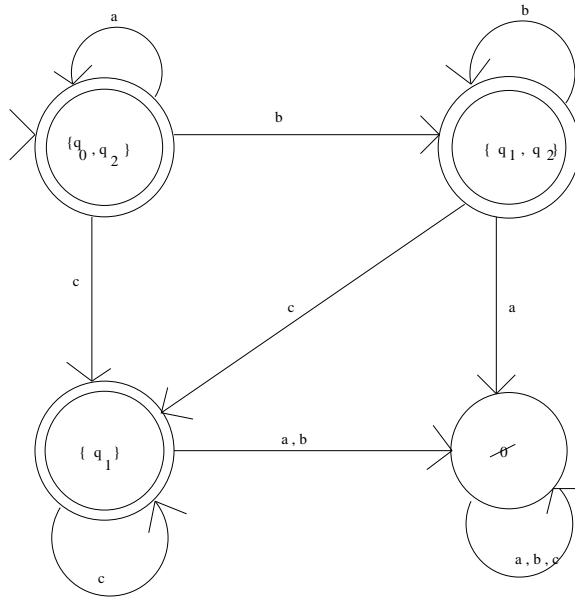
Solution:

(a) $\lambda - closure(q_0) = \{q_0, q_2\}$.

(b) The input transition function t is the following:

t	a	b	c
q ₀	{q ₀ , q ₂ }	{q ₁ , q ₂ }	{q ₁ }
q ₁	∅	∅	{q ₁ }
q ₂	∅	{q ₁ , q ₂ }	∅

(c) The equivalent DFA:



(d) A regular expression is $\mathbf{a^*b^*c^*}$. (20 points)