PR 4 TBFO

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3.1.1

Exercise 3.1.1 : Write regular expressions for the following languages:

a

* a) The set of strings over alphabet $\{a, b, c\}$ containing at least one a and at least one b.

Kemungkinan : xaxbx , xbxax

c a/c a/b/c c b/c a/b/c

RE : $(c)^*(a)(a+c)^*(b)(a+b+c)^* + (c)^*(b)(b+c)^*(a)(a+b+c)^*$

b

b) The set of strings of 0's and 1's whose tenth symbol from the right end is 1.

Kemungkinan : $x1\underbrace{xxxxxxxxx}_{9x}$

0,1 0,1

RE : $(0+1)^*(1)(0+1)^9$

c

c) The set of strings of 0's and 1's with at most one pair of consecutive 1's.

RE : $(0)^*(\varepsilon+0+1)(0+1)(0)^* + ((0)^*(10))^*(\varepsilon+1+11)((0)^*(10))^*$

Accepted : ε, 0, 1, 11, 00, 01, 10, 100, 110, 011, 101, 010, 001

Decline : 111 , 11011 000111

3.1.2

Exercise 3.1.2 : Write regular expressions for the following languages:

(a) a) The set of all strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.

RE: $(10+0)^*(\varepsilon+1)(01+1)^*(\varepsilon+0)$

(b) b) The set of strings of 0's and 1's whose number of 0's is divisible by five.

RE: $(\varepsilon+(1)^*)(0(1)^*0(1)^*0(1)^*0(1)^*0(1)^*)^*$

$\boxed{3.2.1}$

Exercise 3.2.1: Here is a transition table for a DFA:

	0	1
$\rightarrow q_1$	q_2	q_1
q_2	q_3	q_1
$*q_3$	q_3	q_2

(a) a) Give all the regular expressions $R_{ij}^{(0)}$. *Note*: Think of state q_i as if it were the state with integer number i.

$R_{1,1}^{(0)} = 1+\varepsilon$ $\quad R_{2,1}^{(0)} = 1$ $\quad R_{3,1}^{(0)} = \emptyset$

$R_{1,2}^{(0)} = 0$ $\quad R_{2,2}^{(0)} = \varepsilon$ $\quad R_{3,2}^{(0)} = 1$

$R_{1,3}^{(0)} = \emptyset$ $\quad R_{2,3}^{(0)} = 0$ $\quad R_{3,3}^{(0)} = 0+\varepsilon$

(b) b) Give all the regular expressions $R_{ij}^{(1)}$. Try to simplify the expressions as much as possible.

$$R_{1,1}^{(1)} = R_{1,1}^{(0)} + R_{1,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,1}^{(0)}$$
$$= (1+\varepsilon)+(1+\varepsilon)(1+\varepsilon)^*(1+\varepsilon)$$
$$= 1^*$$

$$R_{2,1}^{(1)} = R_{2,1}^{(0)} + R_{2,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,1}^{(0)}$$
$$= 1 + 1(1+\varepsilon)^*(1+\varepsilon)$$
$$= 1^+$$

$$R_{3,1}^{(1)} = R_{3,1}^{(0)} + R_{3,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,1}^{(0)}$$
$$= \emptyset$$

$$R_{1,2}^{(1)} = R_{1,2}^{(0)} + R_{1,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,2}^{(0)}$$
$$= 0 + (1+\varepsilon)(1+\varepsilon)^*0$$
$$= 1^*0$$

$$R_{2,2}^{(1)} = R_{2,2}^{(0)} + R_{2,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,2}^{(0)}$$
$$= \varepsilon + 1(1)^*0$$
$$= \varepsilon + 1^+0$$

$$R_{3,2}^{(1)} = R_{3,2}^{(0)} + R_{3,1}^{(0)}(R_{1,1}^{(0)})^* R_{1,2}^{(0)}$$
$$= 1$$

$R^{(1)}_{1,3} = R^{(0)}_{1,3} + R^{(0)}_{1,1}(R^{(0)}_{1,1})^* R^{(0)}_{1,3}$
$= \emptyset$

$R^{(1)}_{2,3} = R^{(0)}_{2,3} + R^{(0)}_{2,1}(R^{(0)}_{1,1})^* R^{(0)}_{1,3}$
$= 0$

$R^{(1)}_{3,3} = R^{(0)}_{3,3} + R^{(0)}_{3,1}(R^{(0)}_{1,1})^* R^{(0)}_{1,3}$
$= 0 + \varepsilon$

c

c) Give all the regular expressions $R^{(2)}_{ij}$. Try to simplify the expressions as much as possible.

$R^{(2)}_{1,1} = R^{(1)}_{1,1} + R^{(1)}_{1,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,1}$
$= 1^* + 1^*0(\varepsilon + 1^+0)^* 1^+$
$= (1 + 01)^*$

$R^{(2)}_{2,1} = R^{(1)}_{2,1} + R^{(1)}_{2,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,1}$
$= (R^{(1)}_{2,2})^* R^{(1)}_{2,1}$
$= (\varepsilon + 1^+0)1^+$
$= 1^+(\varepsilon + 01^+)$

$R^{(2)}_{3,1} = R^{(1)}_{3,1} + R^{(1)}_{3,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,1}$
$= \emptyset + 1(\varepsilon + 1^+0)^* 1^+$
$= 1(1^+0)^* 1^+$

$R^{(2)}_{1,2} = R^{(1)}_{1,2} + R^{(1)}_{1,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,2}$
$= R^{(1)}_{1,2}(R^{(1)}_{2,2})^*$
$= 1^*0(\varepsilon + 1^+0)^*$
$= (1 + 01)^*0$

$R^{(2)}_{2,2} = R^{(1)}_{2,2} + R^{(1)}_{2,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,2}$
$= (R^{(1)}_{2,2})^+$
$= (\varepsilon + 1^+ + 0)^+$
$= (1^+0)^+$

$R^{(2)}_{3,2} = R^{(1)}_{3,2} + R^{(1)}_{3,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,2}$
$= 1 + 1(\varepsilon + 1^+0)^*$
$= 1(1^+0)$

$R^{(1)}_{1,3} = R^{(1)}_{1,3} + R^{(1)}_{1,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,3}$
$= \emptyset + 1^*0(\varepsilon + 1^+0)^*$
$= (1 + 01)^*0$

$R^{(2)}_{2,3} = R^{(1)}_{2,3} + R^{(1)}_{2,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,3}$
$= (R^{(1)}_{2,3})^* R^{(1)}_{2,3}$
$= (\varepsilon + 1^+0)^*0$
$= (1^+0)^*0$

$R^{(2)}_{3,3} = R^{(1)}_{3,3} + R^{(1)}_{3,2}(R^{(1)}_{2,2})^* R^{(1)}_{2,3}$
$= (0 + \varepsilon) + 1(\varepsilon + 1^+0)^*0$
$= 0 + 1(1^+0)^*0 + \varepsilon$

d

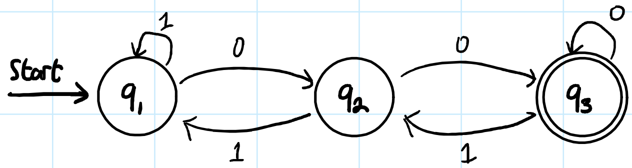
d) Give a regular expression for the language of the automaton.

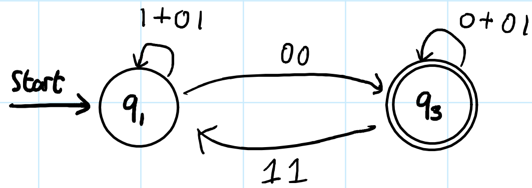
DFA is $R^{(3)}_{1,3}$

$R^{(3)}_{1,3} = R^{(2)}_{1,3} + R^{(2)}_{1,3}(R^{(2)}_{3,3})^* R^{(2)}_{3,3}$
$= R^{(2)}_{1,3}(R^{(2)}_{3,3})^*$
$= (1 + 01)^*00(0 + 1(1^+0)^*0 + \varepsilon))^*$
$= (1 + 01)^*00(0 + 1(1^+0)^*0)^*$

e

e) Construct the transition diagram for the DFA and give a regular expression for its language by eliminating state q_2.





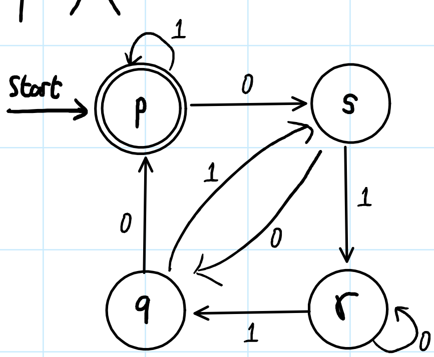
RE : $(1+01+00(0+10)^*11)^*00(0+10)^*$

3.2.3

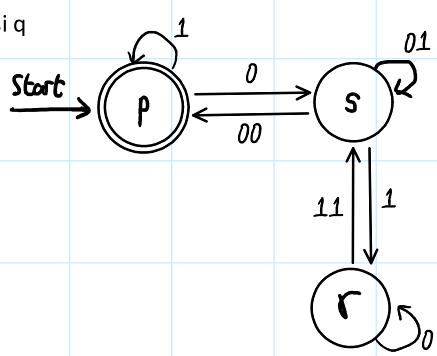
Exercise 3.2.3: Convert the following DFA to a regular expression, using the state-elimination technique of Section 3.2.2.

	0	1
$\rightarrow *p$	s	p
q	p	s
r	r	q
s	q	r

DFA

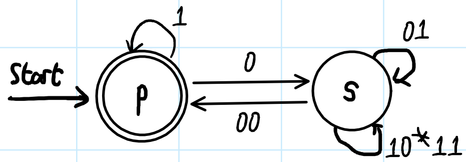


Eliminasi q

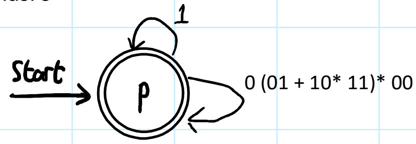


Eliminasi r

Eliminasi r



Eliminasi s



$$RE : (1 + 0(01 + 10^*11)^*00)^*$$