Assignment 2 — draft solution

Advanced Computing Concepts for Engineering

Due Mar 17, 2015

The work that you turn in for this assignment must represent your individual effort. You are welcome to help your fellow students understand the material of the course and the meaning of the assignment questions, however, the answer that you submit must be created by you alone.

Q0. [10]Design a regular expression for a language over {'q', 'b', 'o'} with the following properties.

- Strings in the language begin with a 'q' and end with a 'q'.

- Strings in the language are at least two characters long.

- Between the first 'q' and the final 'q' the string consists of any number of chunks where each chunk is either an 'o' or the two characters "bb" or the two characters "bq".
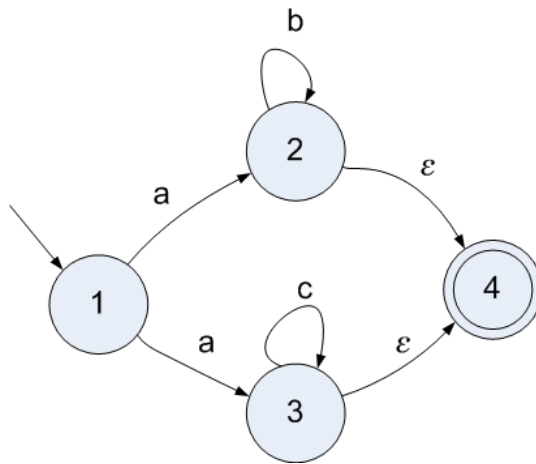
Solution:

$$\text{'q'}; (\text{'o'} \mid \text{'b'}; \text{'b'} \mid \text{'b'}; \text{'q'})^{*}; \text{'q'}$$

Q1[10]. Use Thompson's construction to create an NDFR for the regular expression $((\text{'a'}; \text{'b'}) \mid (\text{'a'}; \text{'c'}))^{*}$
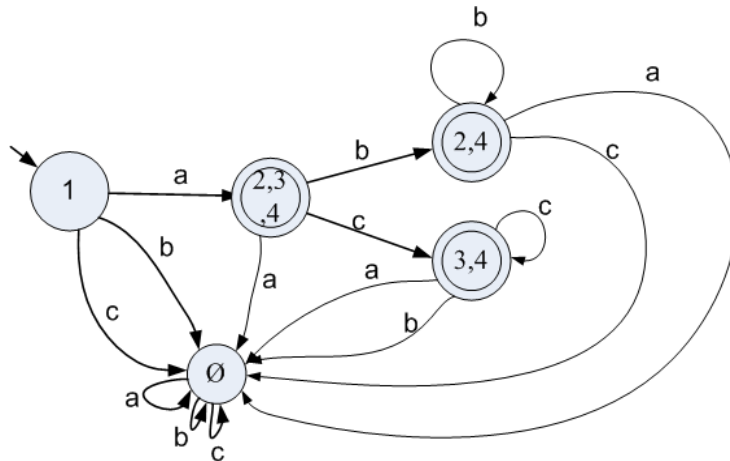
Solution:
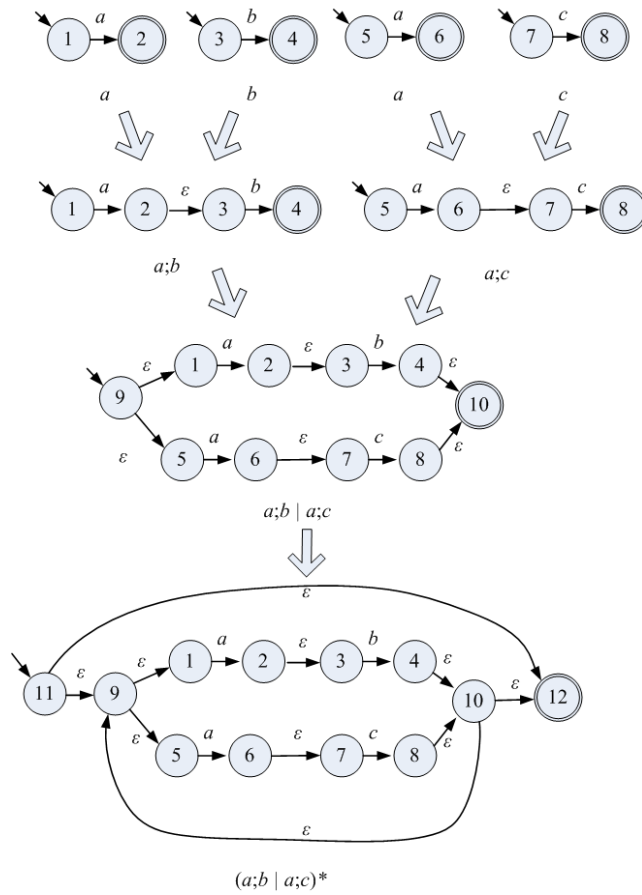
Q2 [10] Use the subset construction algorithm to transform this NDFR into a DFR. Show your work by making a table that shows the trace of the algorithm.
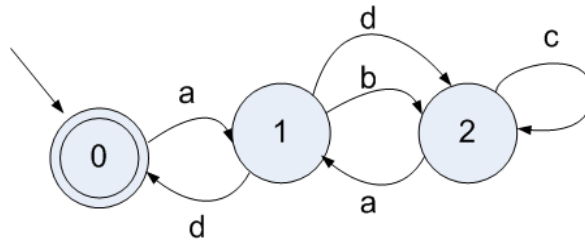
Solution:

| W	$\dot{q}$	a	$\delta(\dot{q}, a)$	ϵ-closure($\delta(\dot{q}, a)$)	transition	is $\dot{q}$ final
$\{\{1\}\}$	$\{1\}$	'a'	$\{2,3\}$	$\{2,3,4\}$	$(\{1\}, \text{'a'}, \{2,3,4\})$	No
		'b'	$\emptyset$	$\emptyset$	$(\{1\}, \text{'b'}, \emptyset)$	
		'c'	$\emptyset$	$\emptyset$	$(\{1\}, \text{'c'}, \emptyset)$	
$\{\{2,3,4\}, \emptyset\}$	$\{2,3,4\}$	'a'	$\emptyset$	$\emptyset$	$(\{2,3,4\}, \text{'a'}, \emptyset)$	Yes
		'b'	$\{2\}$	$\{2,4\}$	$(\{2,3,4\}, \text{'b'}, \{2,4\})$	
		'c'	$\{3\}$	$\{3,4\}$	$(\{2,3,4\}, \text{'c'}, \{3,4\})$	
$\{\emptyset, \{2,4\}, \{3,4\}\}$	$\emptyset$	'a'	$\emptyset$	$\emptyset$	$(\emptyset, \text{'a'}, \emptyset)$	No
		'b'	$\emptyset$	$\emptyset$	$(\emptyset, \text{'b'}, \emptyset)$	
		'c'	$\emptyset$	$\emptyset$	$(\emptyset, \text{'c'}, \emptyset)$	
$\{\{2,4\}, \{3,4\}\}$	$\{2,4\}$	'a'	$\emptyset$	$\emptyset$	$(\{2,4\}, \text{'a'}, \emptyset)$	Yes
		'b'	$\{2\}$	$\{2,4\}$	$(\{2,4\}, \text{'b'}, \{2,4\})$	
		'c'	$\emptyset$	$\emptyset$	$(\{2,4\}, \text{'c'}, \emptyset)$	
$\{\{3,4\}\}$	$\{3,4\}$	'a'	$\emptyset$	$\emptyset$	$(\{3,4\}, \text{'a'}, \emptyset)$	Yes
		'b'	$\emptyset$	$\emptyset$	$(\{3,4\}, \text{'b'}, \emptyset)$	
		'c'	$\{3\}$	$\{3,4\}$	$(\{3,4\}, \text{'c'}, \{3,4\})$	

Q3 [10] Convert the following NDFR to a regular expression. Show the intermediate REFRs.

Solution: Depending on the order that states are eliminated a variety of answers are possible. I decided to eliminate states in order 2, 1, 0.
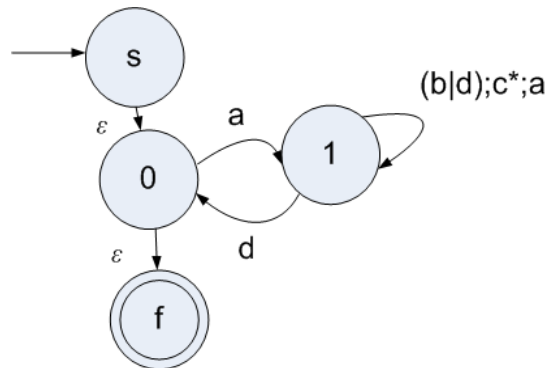
First we ensure that the start state has no incoming transitions and the final state has no outgoing transitions.
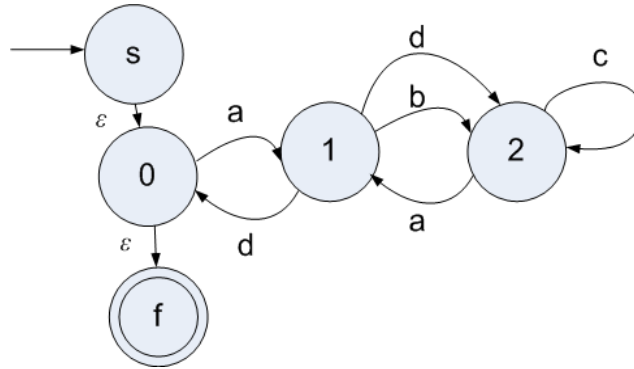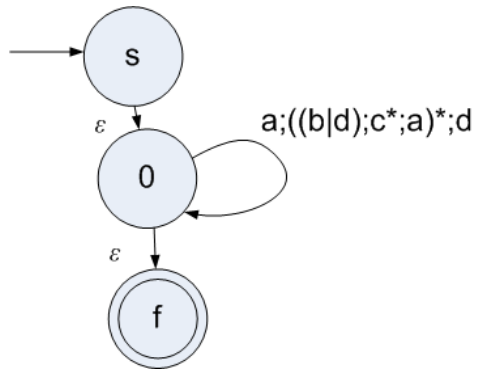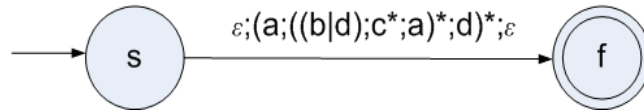

Second the two transitions from 1 to 2 are coalesced.
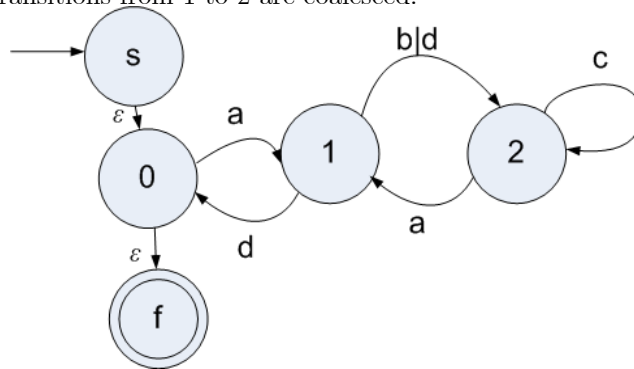
Third, state 2 is eliminated.

Next state 1 is eliminated.

Finally state 0 is eliminated

With the obvious simplification we get

$$\left(a;\left((b|d)\,;c^{*};a\right)^{*};d\right)^{*}$$