CS308 Homework 1

Exercises for Algorithm Design and Analysis by Li Jiang, 2016 Autumn Semester

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Coverage : This assginment covers the chapter 3.7 incluing coverting NFA to DFA, regular expression to DFA and transition table.

1. (Section 3.7, Exercises 3.7.1) Convert to DFA's the NFA's of:

   (a) Fig. 3.26.

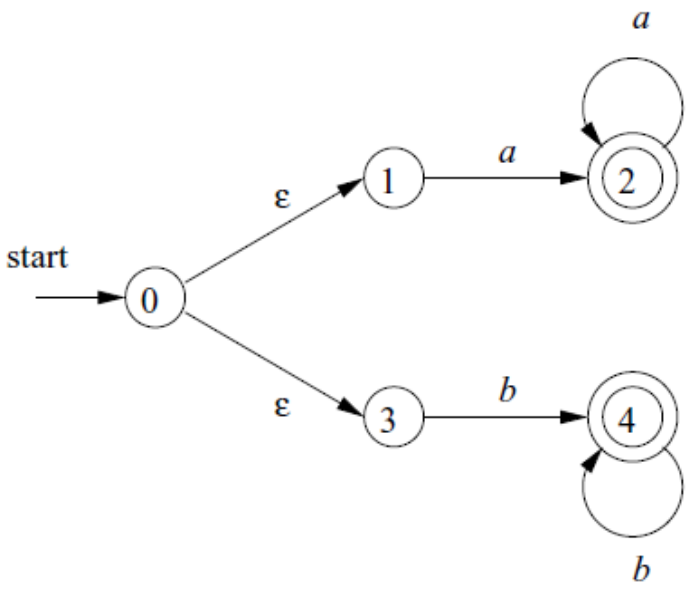


图 1: Fig. 3.26.

   (b) Fig. 3.29.

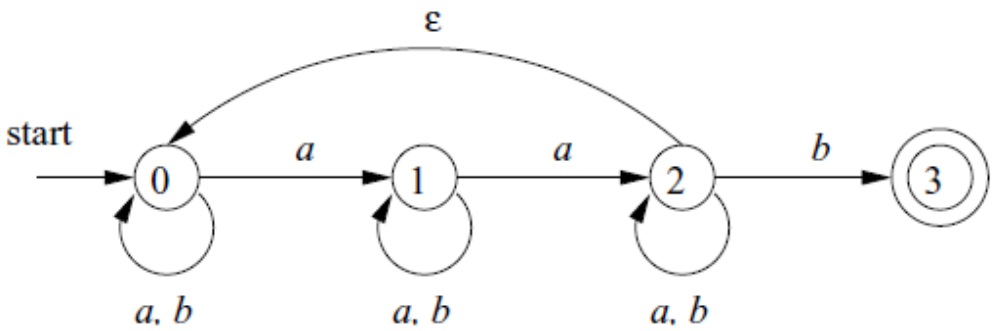


图 2: Fig. 3.29.

(c) Fig. 3.30.

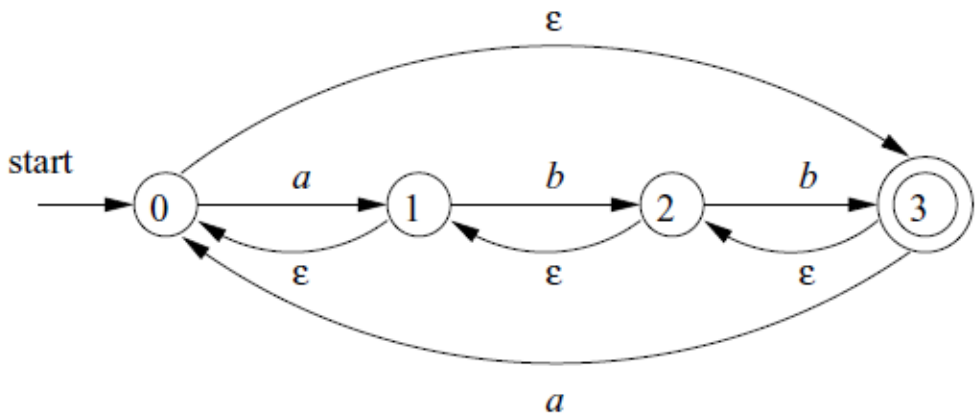


图 3: Fig. 3.30.

(a) solution of a

NFA state	DFA state	a	b
{ 0, 1, 3 }	A	B	C
{ 2 }	B	B	∅
{ 4 }	C	∅	C

表 1: transition table

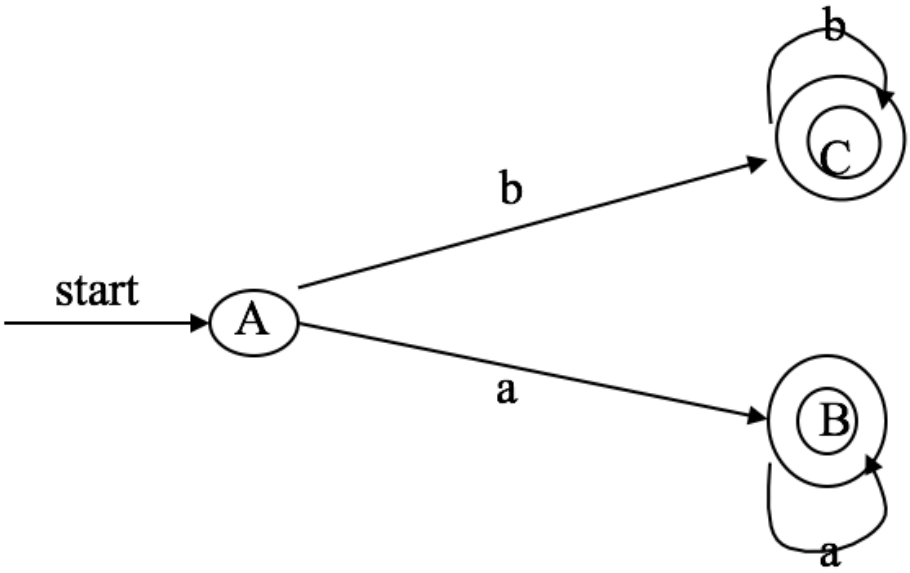


图 4: DFA

(b) solution of b

NFA state	DFA state	a	b
{ 0 }	A	B	A
{ 0, 1 }	B	C	B
{ 0, 1, 2 }	C	C	D
{ 0, 1, 2, 3 }	D	C	D

表 2: transition table

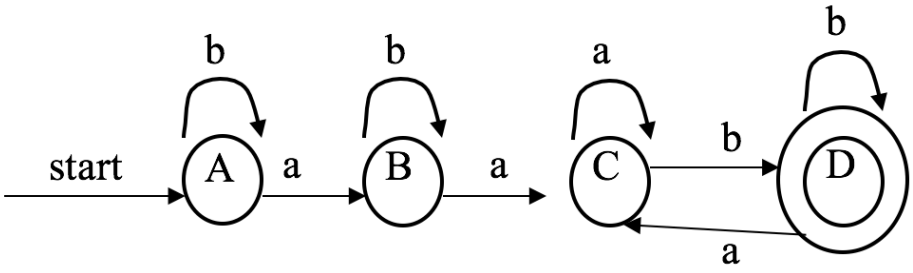


图 5: DFA

(c) solution of c

NFA state	DFA state	a	b
{ 0, 1, 2, 3 }	A	A	A

表 3: transition table

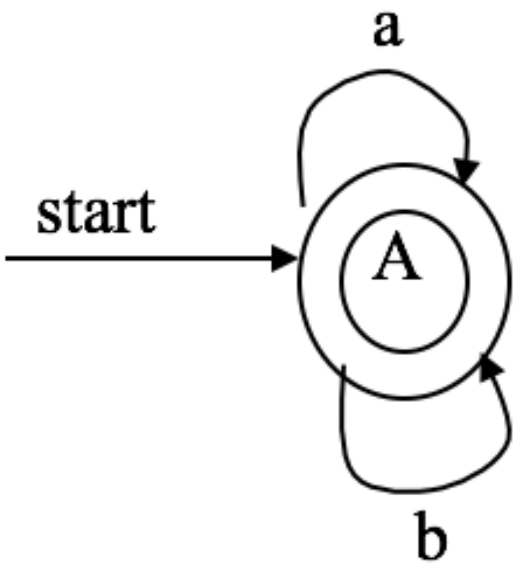


图 6: DFA

2. (Section 3.7, Exercises 3.7.2) use Algorithm 3.22 to simulate the NFA's on input $aabb$ regarding the above Fig 3.29 and Fig 3.30.

   Algorithm 3.22:

   INPUT: An input string x terminated by an end-of-file character eof. An NFA N with start state s_0, accepting states F, and transition function move.

   OUTPUT: Answer "yes" if N accepts x. Answer "no" otherwise.

   EXAMPLE: $-start-> \{0\} - a-> \{0,1\} - a-> \{0,1,2\} - b-> \{0,2,3\} - b-> \{0,2,3\}$

   Solutions:
   1. $-start-> \{0\} - a-> \{0,1\} - a-> \{0,1,2\} - b-> \{0,1,2,3\} - b-> \{0,1,2,3\}$
   2. $-start-> \{0,1,2,3\} - a-> \{0,1,2,3\} - a-> \{0,1,2,3\} - b-> \{0,1,2,3\} - b-> \{0,1,2,3\}$

3. (Section 3.7, Exercises 3.7.3) Convert the following regular expressions to deterministic finite automata, using algorithms 3.23 and 3.20:

   Algorithm 3.20:

   INPUT: An NFA N.

   OUTPUT:A DFA D accepting the same language as N.

   Algorithm 3.23:

   INPUT:A regular expression r over alphabet $\sum$.

   OUTPUT: An NFA N accepting $L(r)$.

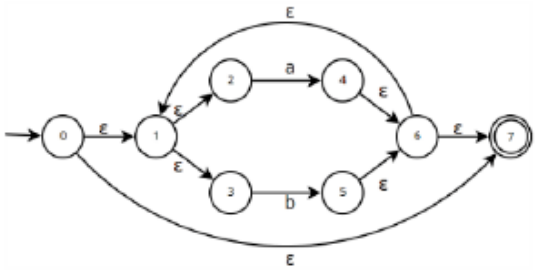
   (a) $(a|b)^*$

   (b) $(a^*|b^*)^*$

   (c) $((\varepsilon|a)|b^*)^*$

EXAMPLE:

NFA:



Transition table:

NFA State	DFA State	a	b
{0,1,3}	A	B	C
{2}	B	B	0
{4}	C	0	C

DFA:

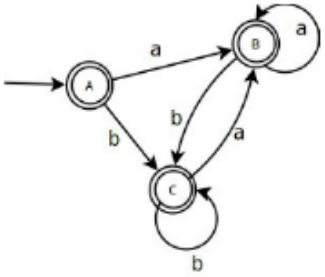


图 7: An example.

Solutions:

(a) $(a|b)^*$

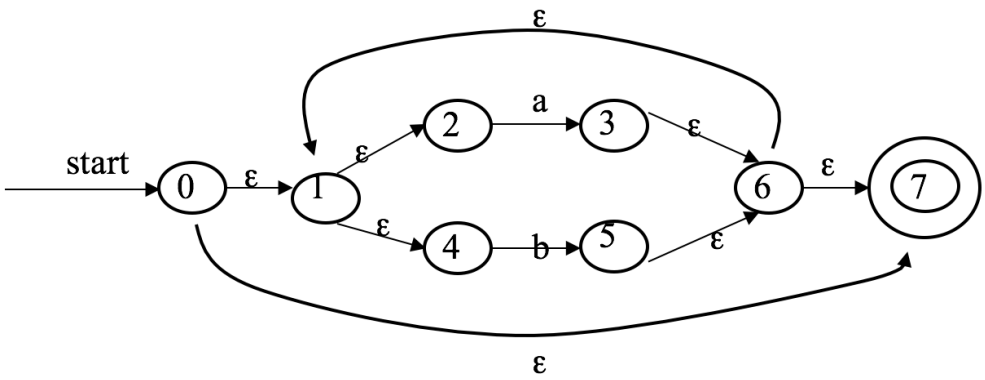


图 8: NFA

NFA state	DFA state	a	b
{ 0, 1, 2, 4, 7 }	A	B	C
{ 1, 2, 3, 4, 6, 7 }	B	B	C
{ 1, 2, 4, 5, 6, 7 }	C	B	C

表 4: transition table

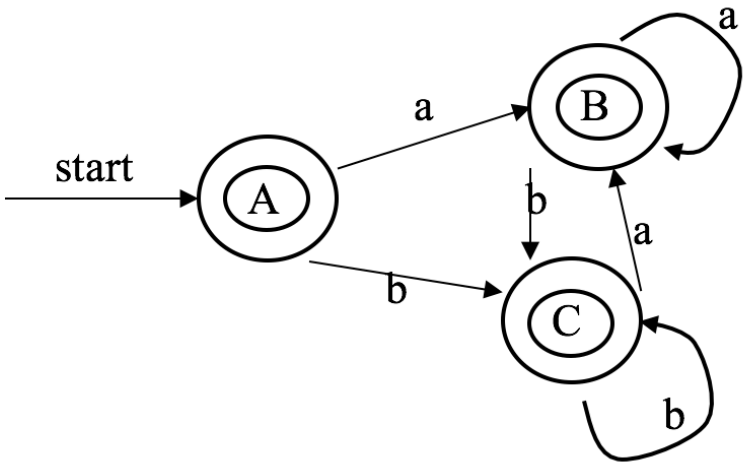


图 9: DFA

(b) $(a^*|b^*)^*$

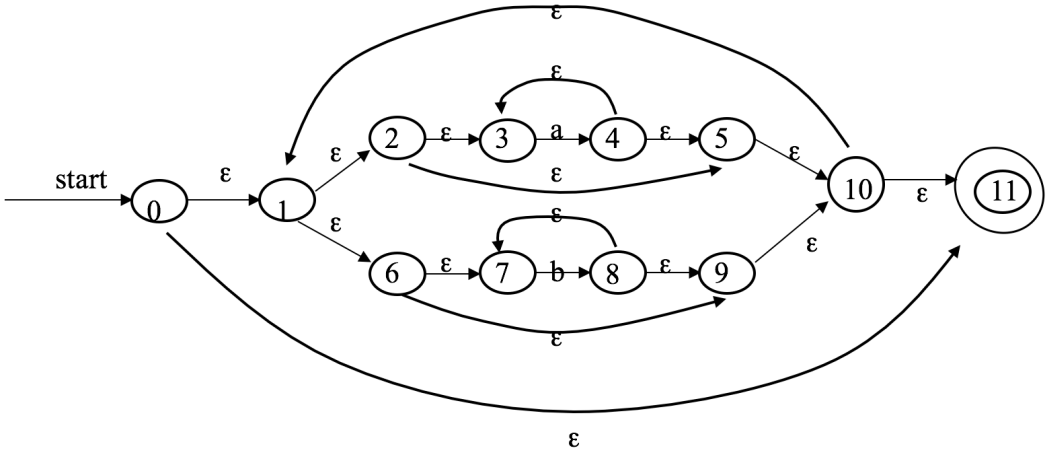


图 10: NFA

NFA state	DFA state	a	b
{ 0, 1, 2, 3, 5, 6 ,7, 9, 10, 11 }	A	B	C
{ 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 }	B	B	C
{ 1, 2, 3, 5, 6, 7, 8, 9, 10, 11 }	C	B	C

表 5: transition table

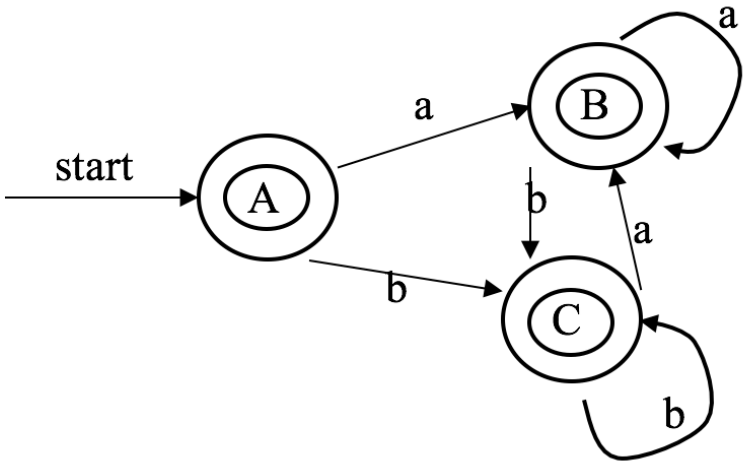


图 11: DFA

(c) $((\varepsilon|a)|b^*)^*$

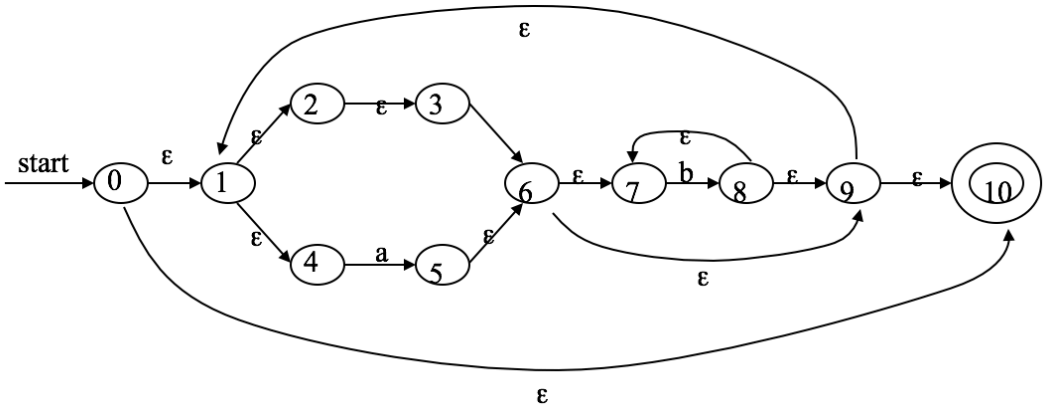


图 12: NFA

NFA state	DFA state	a	b
{ 0, 1, 2, 3, 4, 6 ,7, 9, 10 }	A	B	C
{ 1, 2, 3, 4, 5, 6, 7, 9, 10 }	B	B	C
{ 1, 2, 3, 4, 6, 7, 8, 9, 10 }	C	B	C

表 6: transition table

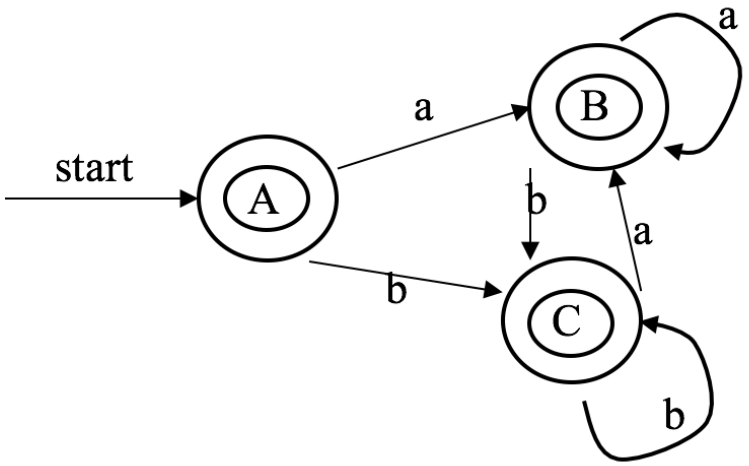


图 13: DFA