南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

COMPILIER @BY 2019

for SUSTech CSE

HomeWork 2

Edited by

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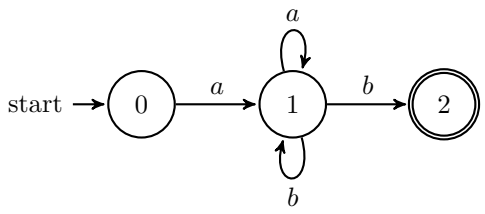
2019
SHENZHEN

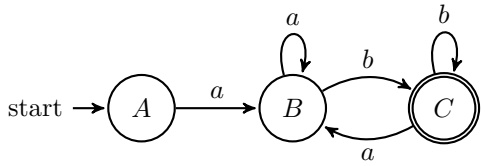
1 Exercise 1: Design finite automata (both deterministic and nondeterministic) for each of the following regular languages:

1.1 L(a(a|b)*b) [10 points]

1.1.1 NFA

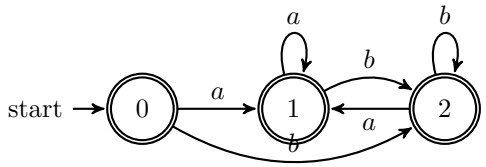


1.1.2 DFA

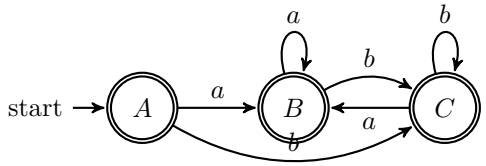


1.2 L(((ϵ|a)*b*)*) [10 points]

1.2.1 NFA

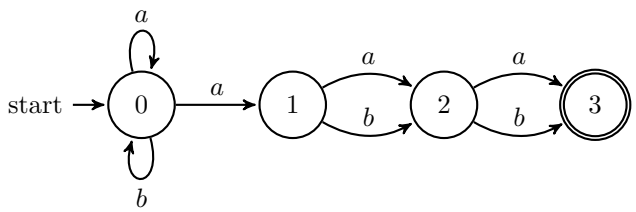


1.2.2 DFA

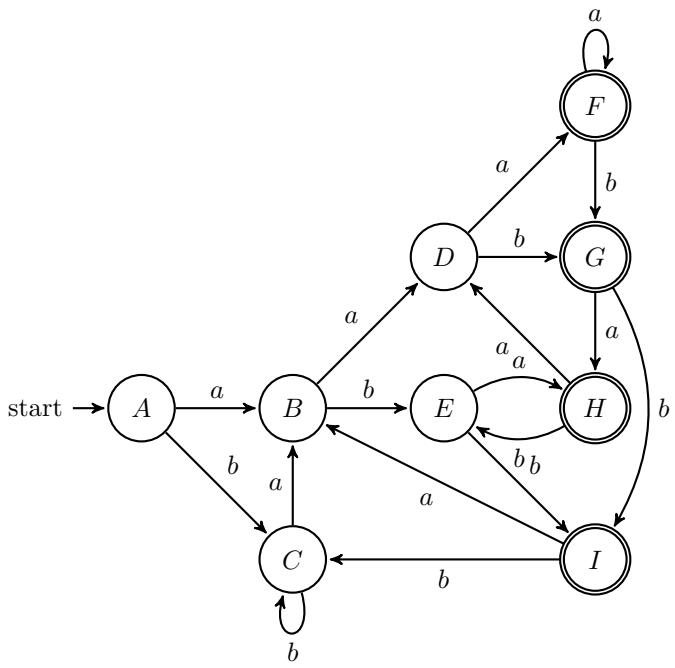


1.3 L((a|b)*a(a|b)(a|b)) [10 points]

1.3.1 NFA



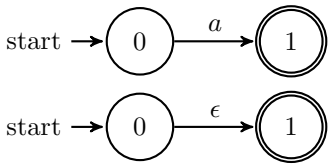
1.3.2 DFA



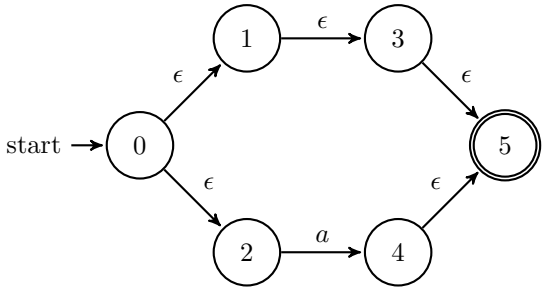
2 Exercise 2: Convert the following regular expressions to NFAs using the Thompson's Construction Algorithm (Algorithm 3.23 in the dragon book).

2.1 ((ϵ|a)*b*)* [10 points]

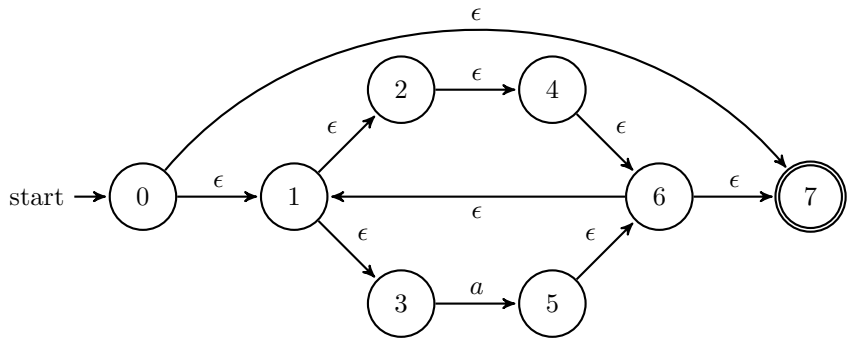
- Use the Basis Rule 1:

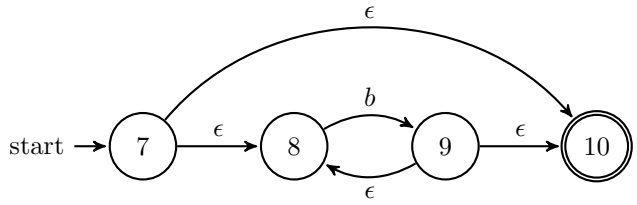


- Use the Inductive Rule for the union case:

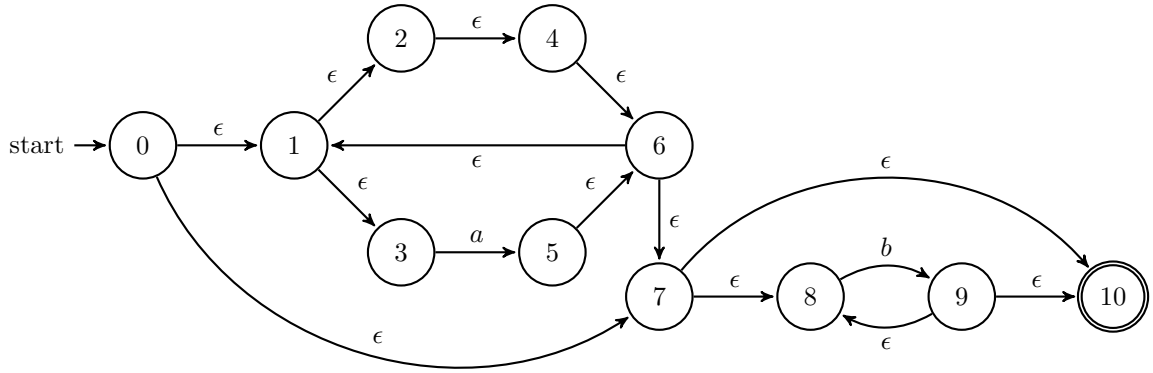


- Use the Inductive Rule for the kleene star case:

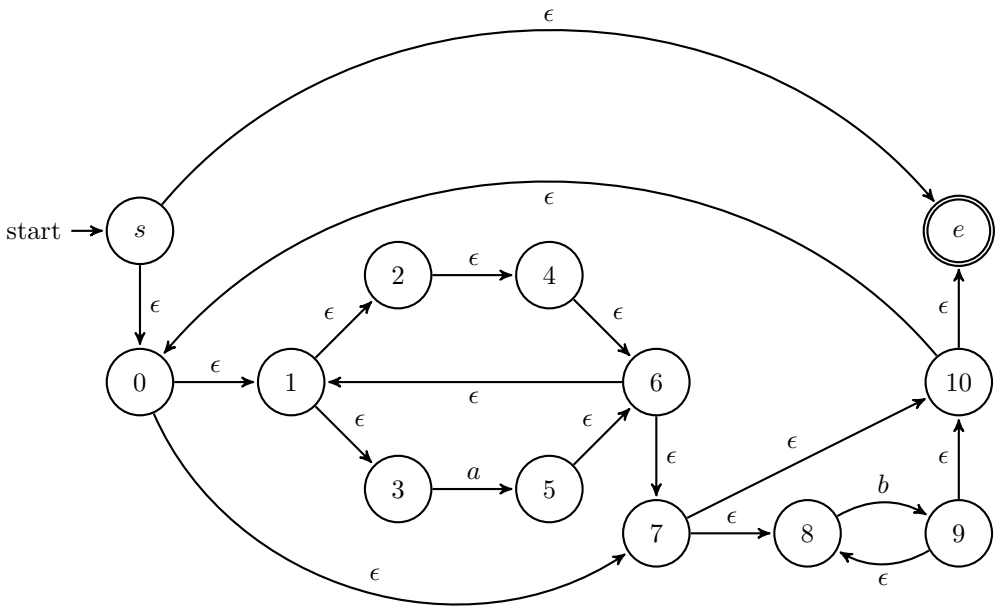




- Use the Inductive Rule for the concatenation case:

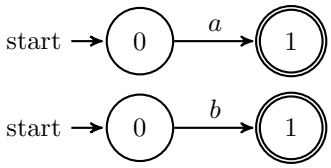


- Use the Inductive Rule for kleene start case

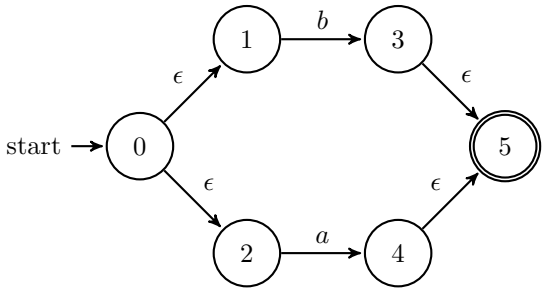


2.2 (a|b)*a(a|b)(a|b)[10 points]

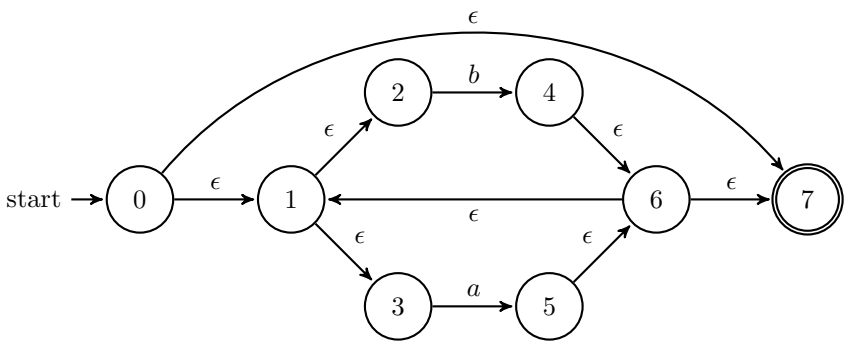
- Use the Basis Rule 1:



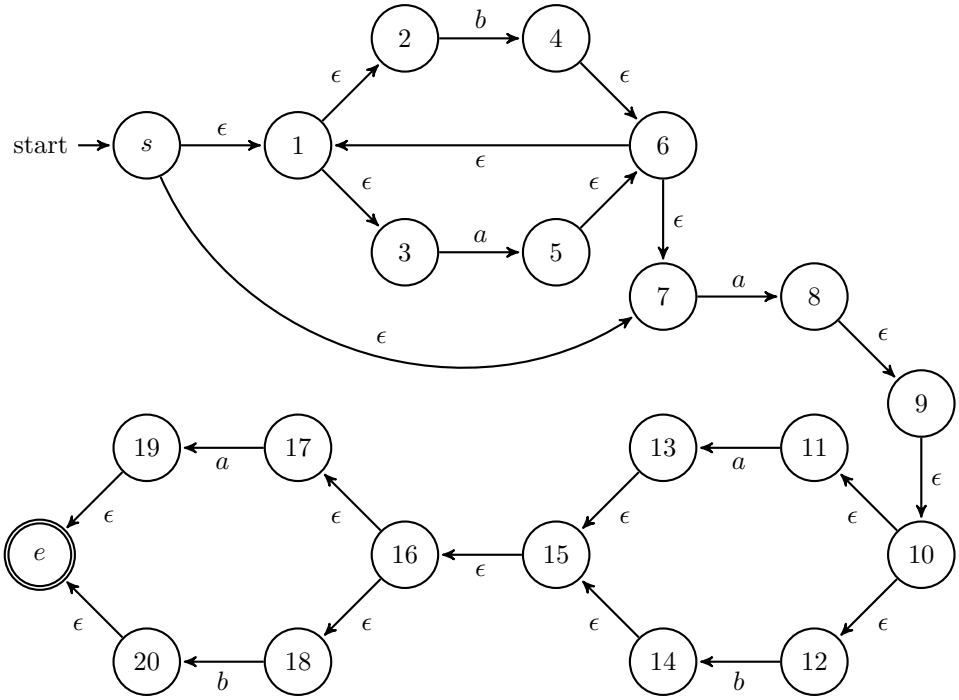
- Use the Inductive Rule for the union case:



- Use the Inductive Rule for the kleene star case:

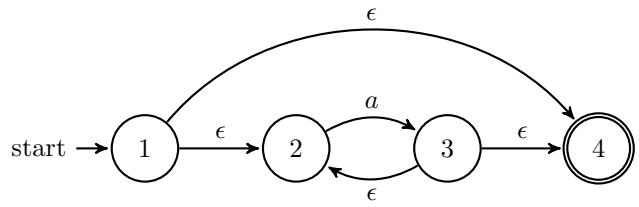


- Use the Inductive Rule for the concatenation case:

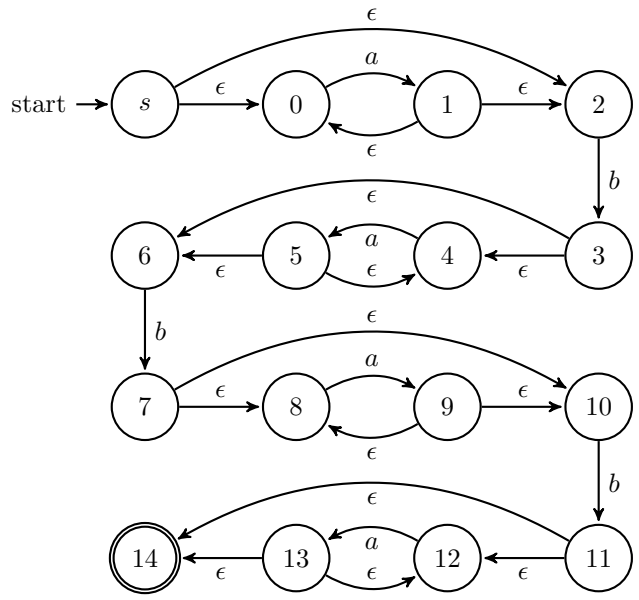


2.3 a*ba*ba*ba* [10 points]

- Use the Inductive Rule for the kleene star case:



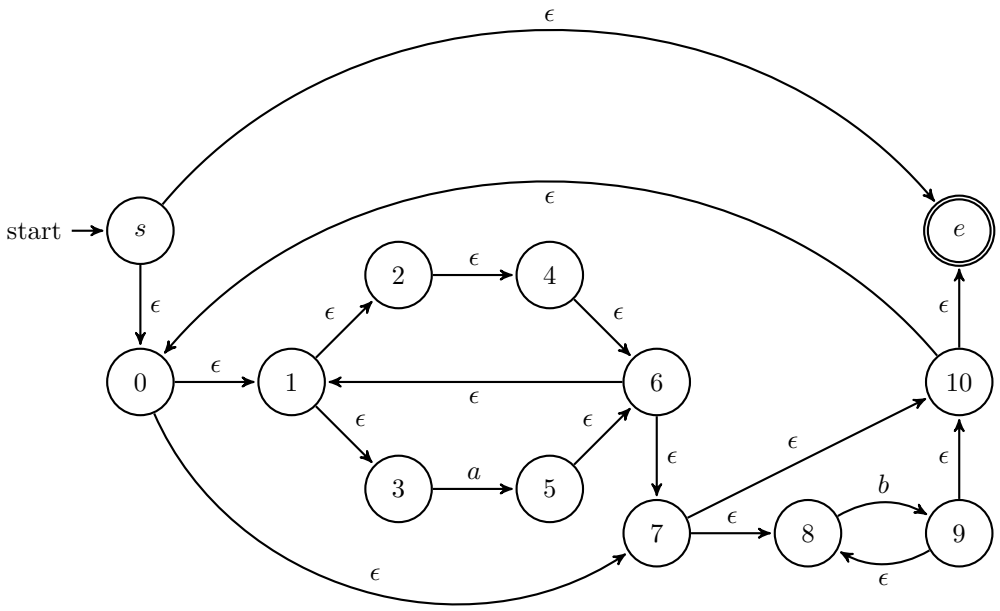
- Use the Inductive Rule for the concatenation case:



3 Exercise 3: Convert the NFAs in Exercise 2 to DFAs using the Subset Construction Algorithm (Algorithm 3.20 in the dragon book). [30 points in total; 10 points for each correct conversion]

3.1 ((ϵ|a)* b*)* [10 points]

NFA is :



If use the subset construction algorithm:

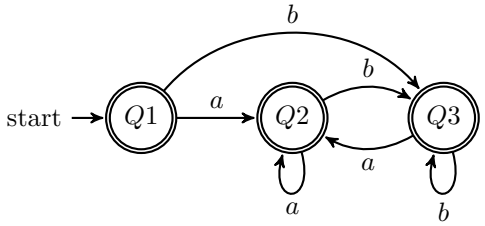
1. Q1 = {s,0,1,2,3,4,6,7,8,10,e}
2. Q2 = {0,1,2,3,4,5,6,7,8,10,e}
3. Q3 = {0,1,2,3,4,6,7,8,9,10,e}

DFA status transfer table:

Table 1: ((ϵ|a)* b*)*

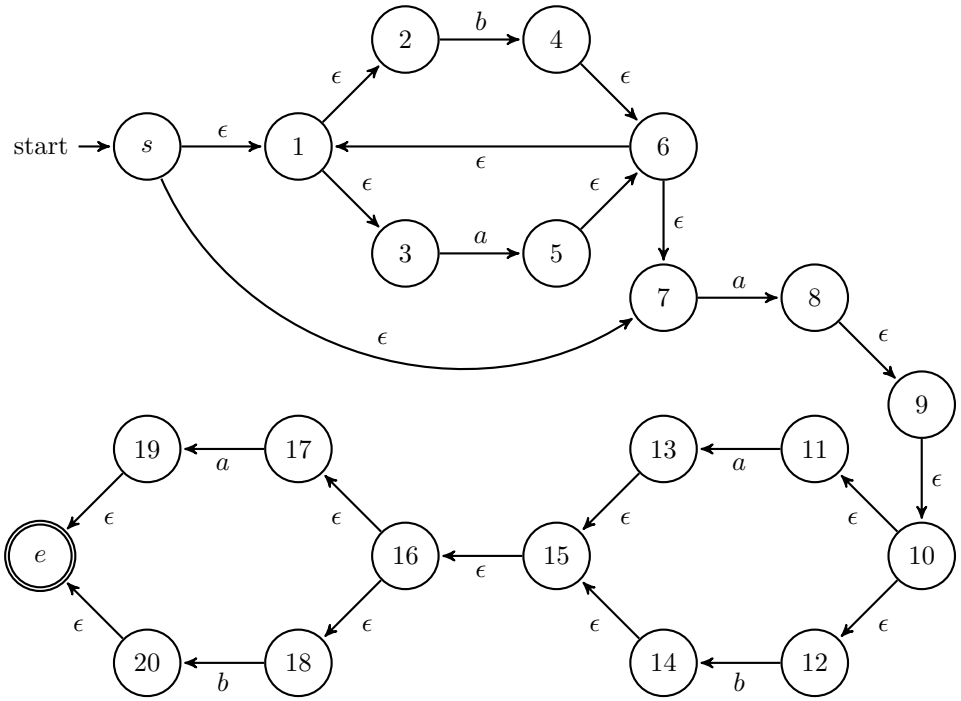
DFA Status	a	b
Q1	Q2	Q3
Q2	Q2	Q3
Q3	Q2	Q3

DFA



3.2 (a|b)*a(a|b)(a|b)[10 points]

NFA is:



If use the subset construction algorithm:

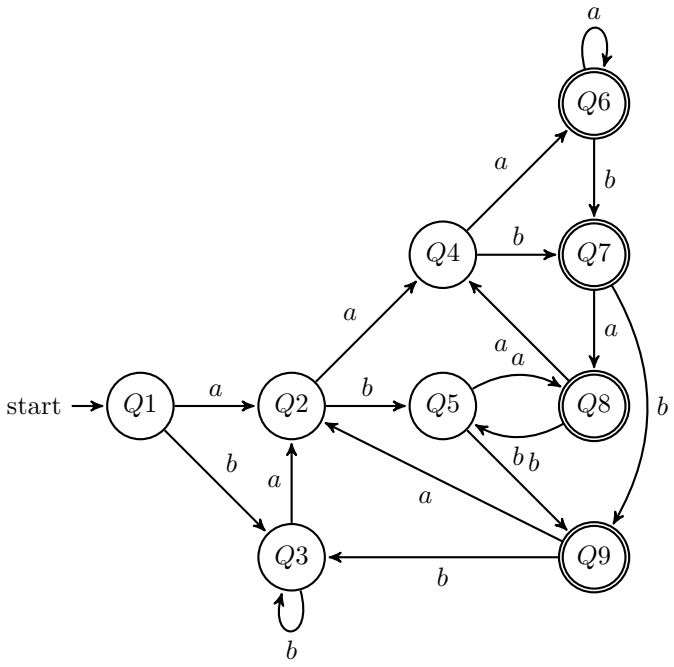
1. Q1 = {s,1,2,3,7}
2. Q2 = {1,2,3,5,6,7,8,9,10,11,12}
3. Q3 = {1,2,3,4,6,7}
4. Q4 = Q2+{13,15,16,17,18}
5. Q5 = Q3+{14,15,16,17,18}
6. Q6 = Q4+{19,e}
7. Q7 = Q5+{20,e}
8. Q8 = Q2+{19,e}
9. Q9 = Q3+{20,e}

DFA status transfer table:

Table 2: (a|b)*a(a|b)(a|b)[10 points]

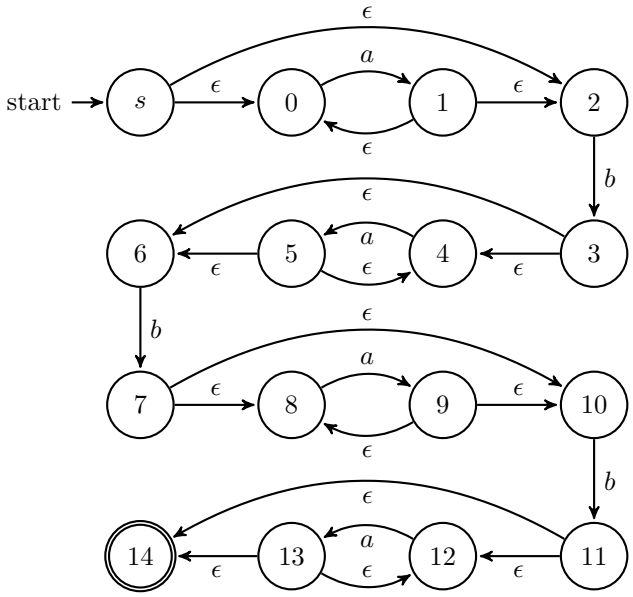
DFA Status	a	b
Q1	Q2	Q3
Q2	Q4	Q5
Q3	Q2	Q3
Q4	Q6	Q7
Q5	Q8	Q9
Q6	Q6	Q7
Q7	Q8	Q9
Q8	Q4	Q5
Q9	Q2	Q3

DFA is:



3.3 a*ba*ba*ba* [10 points]

NFA is:



If use the subset construction algorithm:

1. Q1 = {s,0,2}
2. Q2 = {0,1,2}
3. Q3 = {3,4,6}
4. Q4 = {4,5,6}
5. Q5 = {7,8,10}
6. Q6 = {8,9,10}

7. Q7 = {11,12,14}
8. Q8 = {12,13,14}

DFA status transfer table:

Table 3: a*ba*ba*ba*

DFA Status	a	b
Q1	Q2	Q3
Q2	Q2	Q3
Q3	Q4	Q5
Q4	Q4	Q5
Q5	Q6	Q7
Q6	Q6	Q7
Q7	Q8	ϵ
Q8	Q8	ϵ

DFA: