CSE211 – Formal Languages and Automata Theory

U1L16 – DFA to Regular Expressions Tutorial

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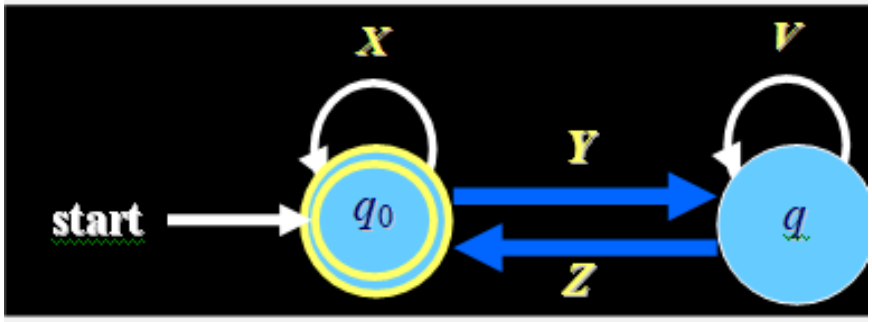
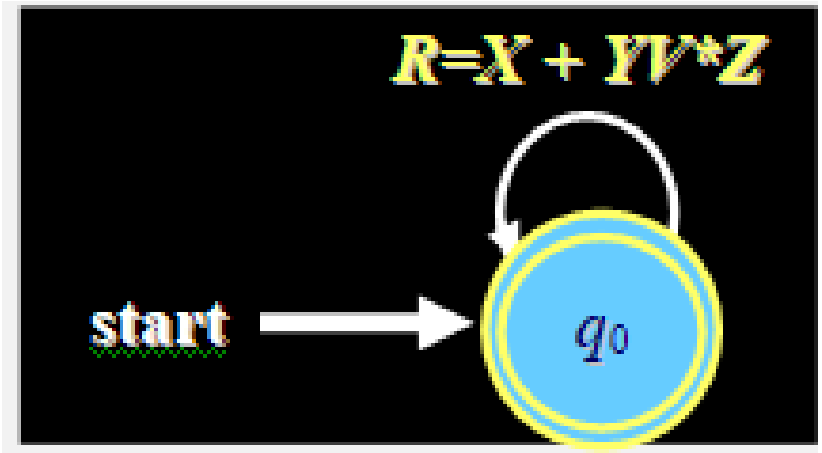
Agenda

- Converting DFA to RE
- Exercise for DFA to RE conversion

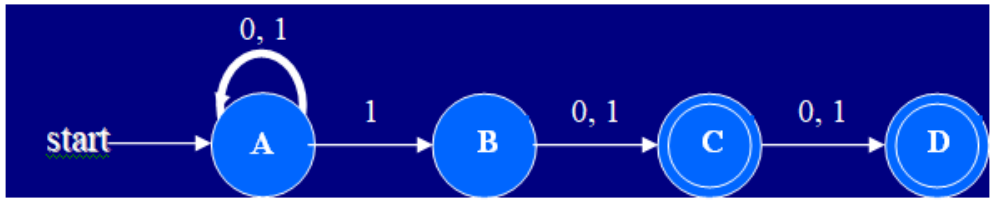
Converting DFA's to RE's by State Elimination



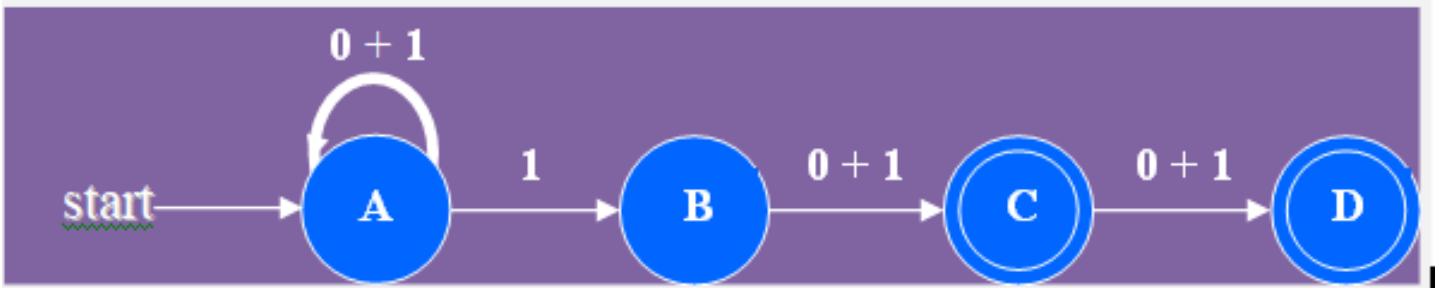


State Elimination Method

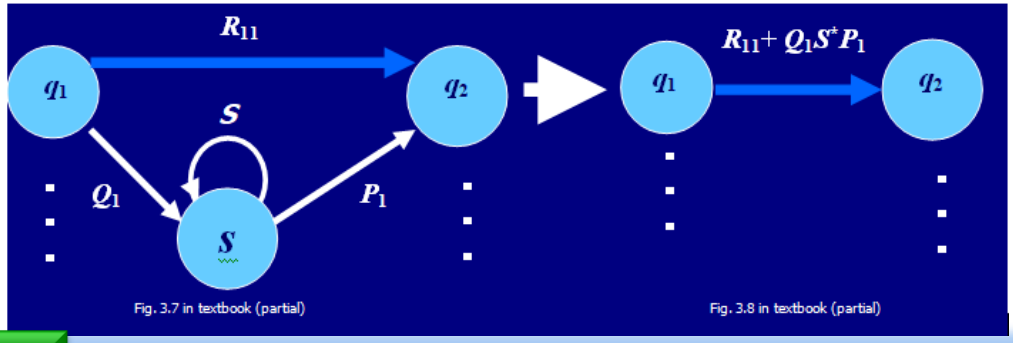
- Convert the following DFA into RE



- Step 1: regard symbols on arcs as RE's;

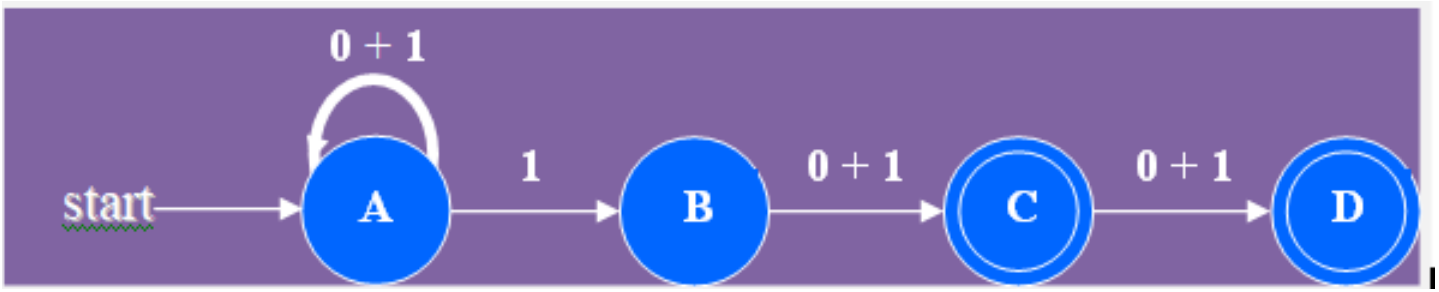


- Step 2: conduct each of the type of conversion by applying

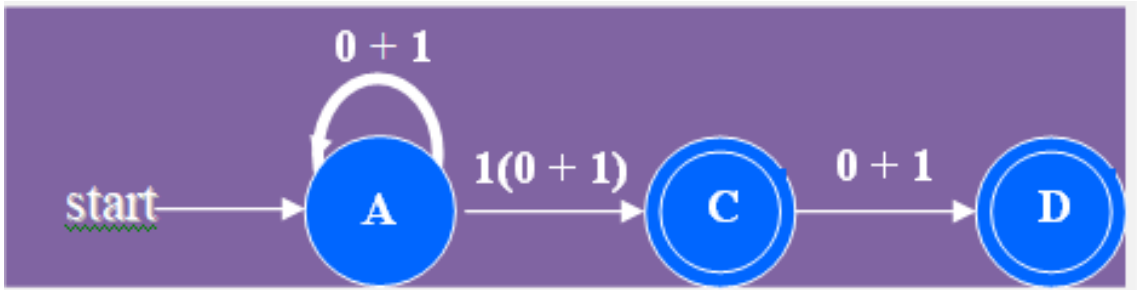


1. Remove B
2. Remove C
3. Remove D

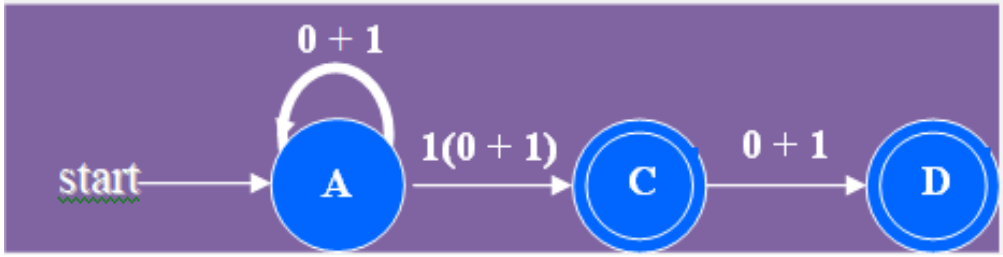
State Elimination Method



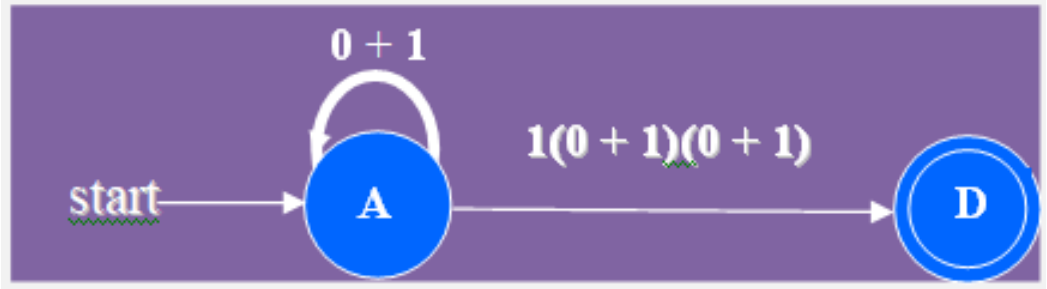
- Step 2: to remove B, applying the state-elimination conversion shown in Fig. 3.11 (a repetition of Fig. 3.4), we get s = B, q_1 = A, q_2 = C, $S = \phi$, $Q_1 = \mathbf{1}$, $P_1 = \mathbf{0 + 1}$, $R_{11} = \phi$ so that
  - $R_{11} + Q_1 S^* P_1 = \phi + \mathbf{1}\,\phi^*(\mathbf{0 + 1}) = \mathbf{1}\,\varepsilon(\mathbf{0 + 1}) = \mathbf{1(0 + 1)}$.



For Final State D



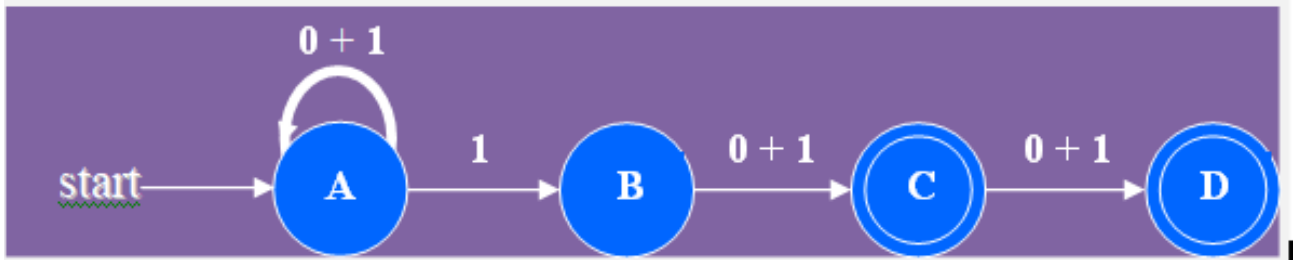
- Step 2: for the final state D, we have to remove C, resulting in s = C, q_1 = A, q_2 = D, $S = \phi$, $Q_1 = \mathbf{1(0 + 1)}$, $P_1 = \mathbf{0 + 1}$, $R_{11} = \phi$, so that
  - $R_{11} + Q_1 S^* P_1 = \phi + \mathbf{1(0 + 1)}\,\phi^{*}\mathbf{(0 + 1)} = \mathbf{1(0 + 1)(0 + 1)}$.



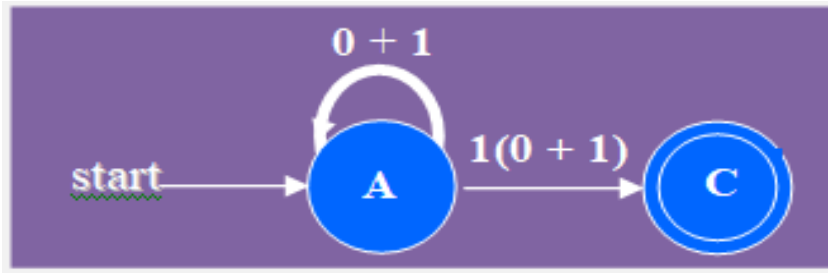
- Via A => $= \mathbf{(0 + 1)^{*}1(0 + 1)(0 + 1)}$.

For Final State C

- for the other final state C, starting from Fig. , we have to eliminate D using the



- since D has no successor, deleting D has no effect to the other parts, resulting in the diagram shown



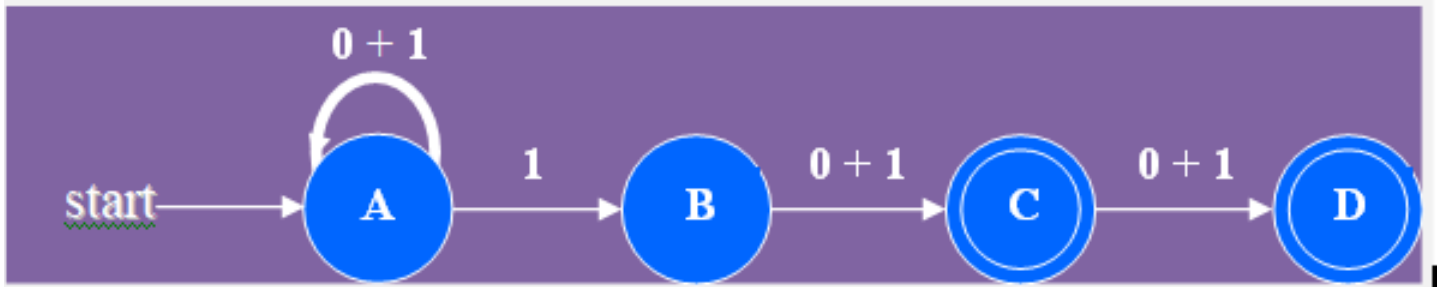
- Via A => $= (0 + 1)^{*}1(0 + 1)$.

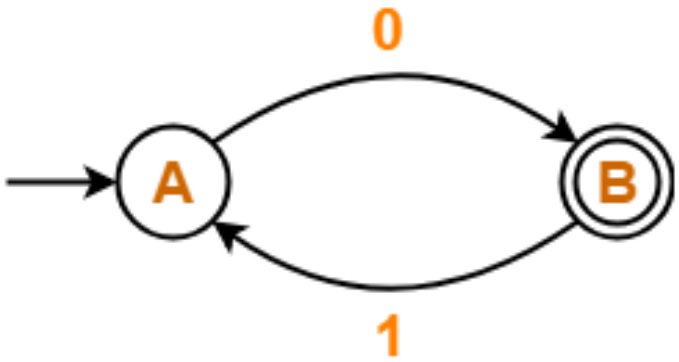
Combining the DFAs

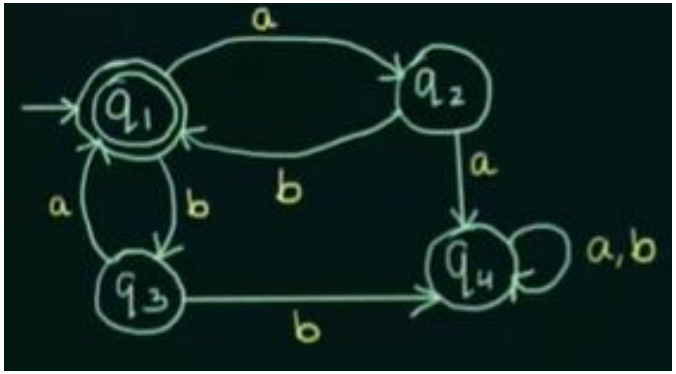
- Step 3: the final result is a sum of the previous two derivation results:

  desired RE = $(0 + 1)^*1(0 + 1) + (0 + 1)^*1(0 + 1)(0 + 1)$

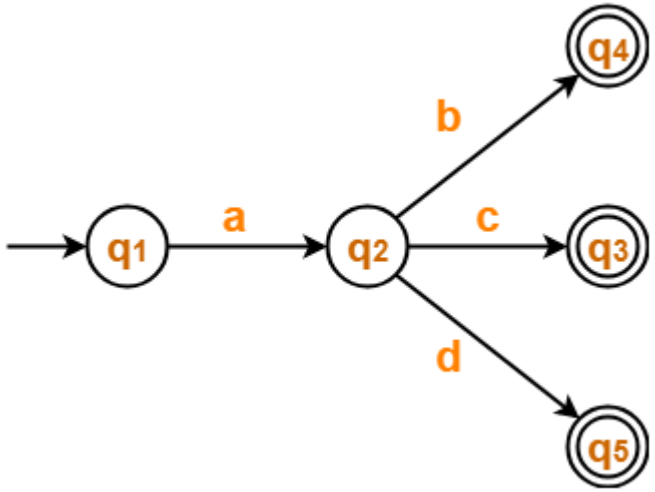
- which may be checked for its correctness.

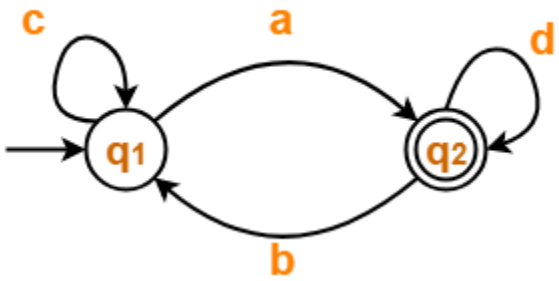


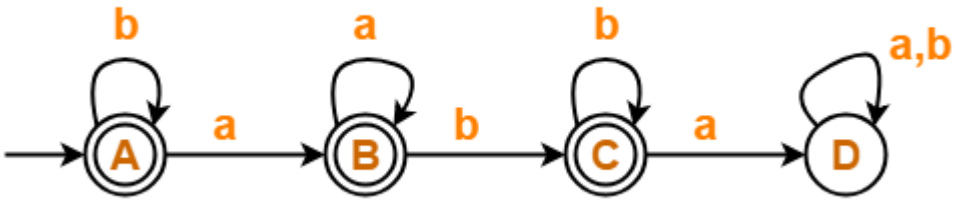

0
A
B
1



$(ab+ba)^*$


q1
a
q2
b
c
d
q3
q4
q5


c
a
d
q1
q2
b


b
a
b
a,b
a
b
a
A
B
C
D

Summary

- Converting DFA to RE
- Exercise for DFA to RE conversion

References

- John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, *Introduction to Automata Theory*, Languages, and Computation, Pearson, 3rd Edition, 2011.
- Peter Linz, An Introduction to Formal Languages and Automata, Jones and Bartle Learning International, United Kingdom, 6th Edition, 2016.

Next Class:

Regular Expression to e-NFA

THANK YOU.