Theory of Computation (CS F351)

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State Minimization in a Finite Automata (Sec. 2.5 of T1)

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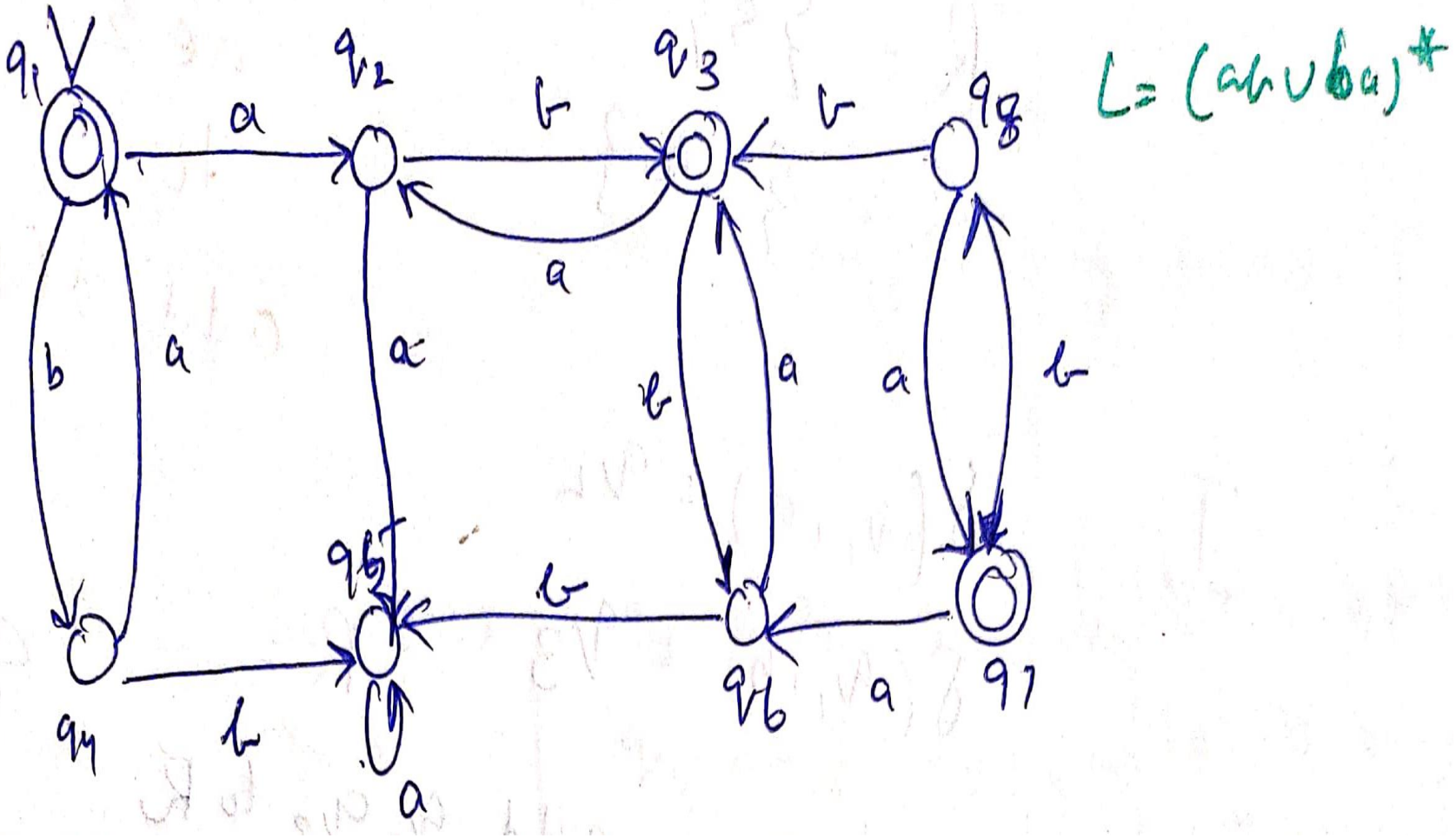
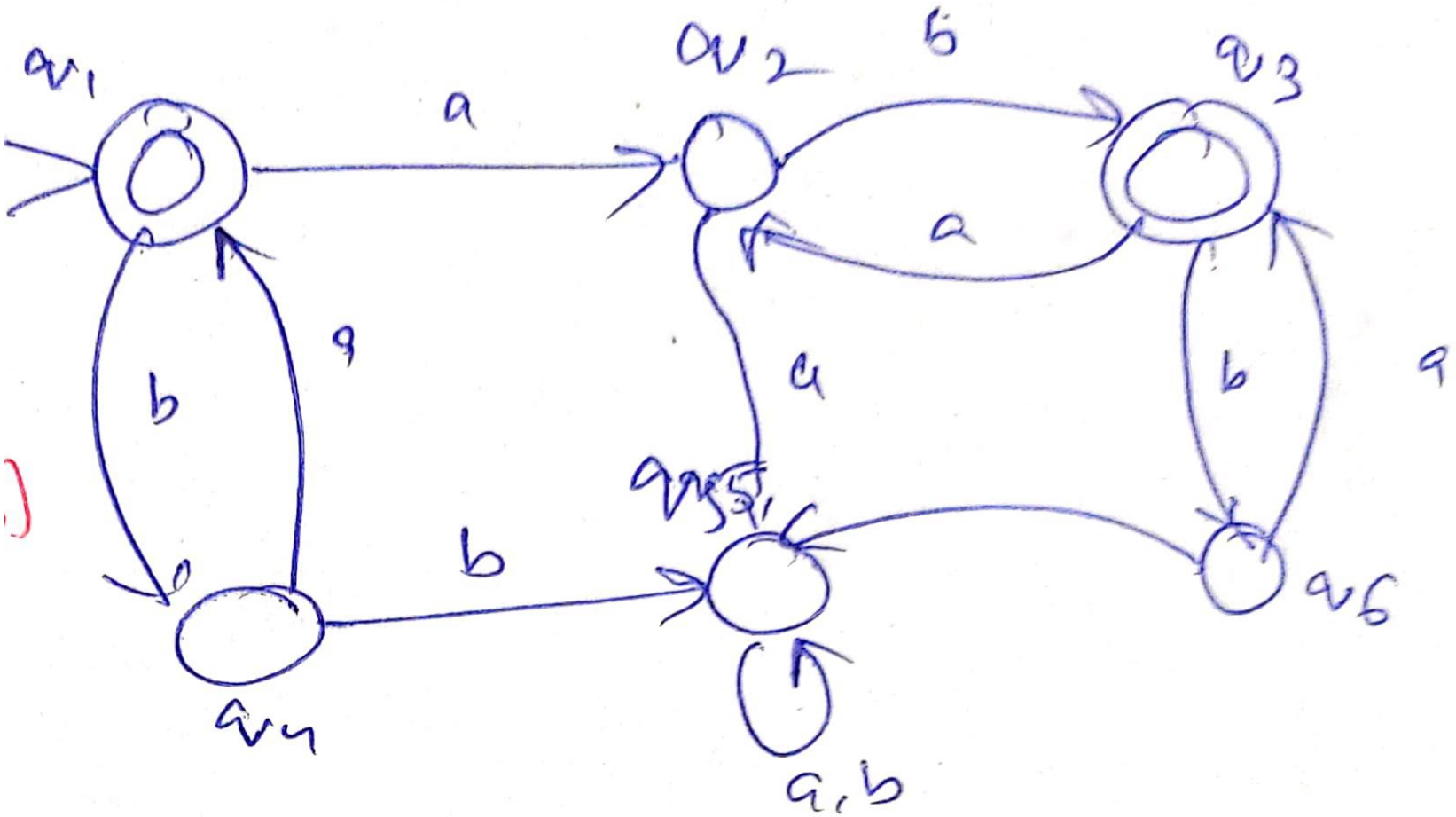
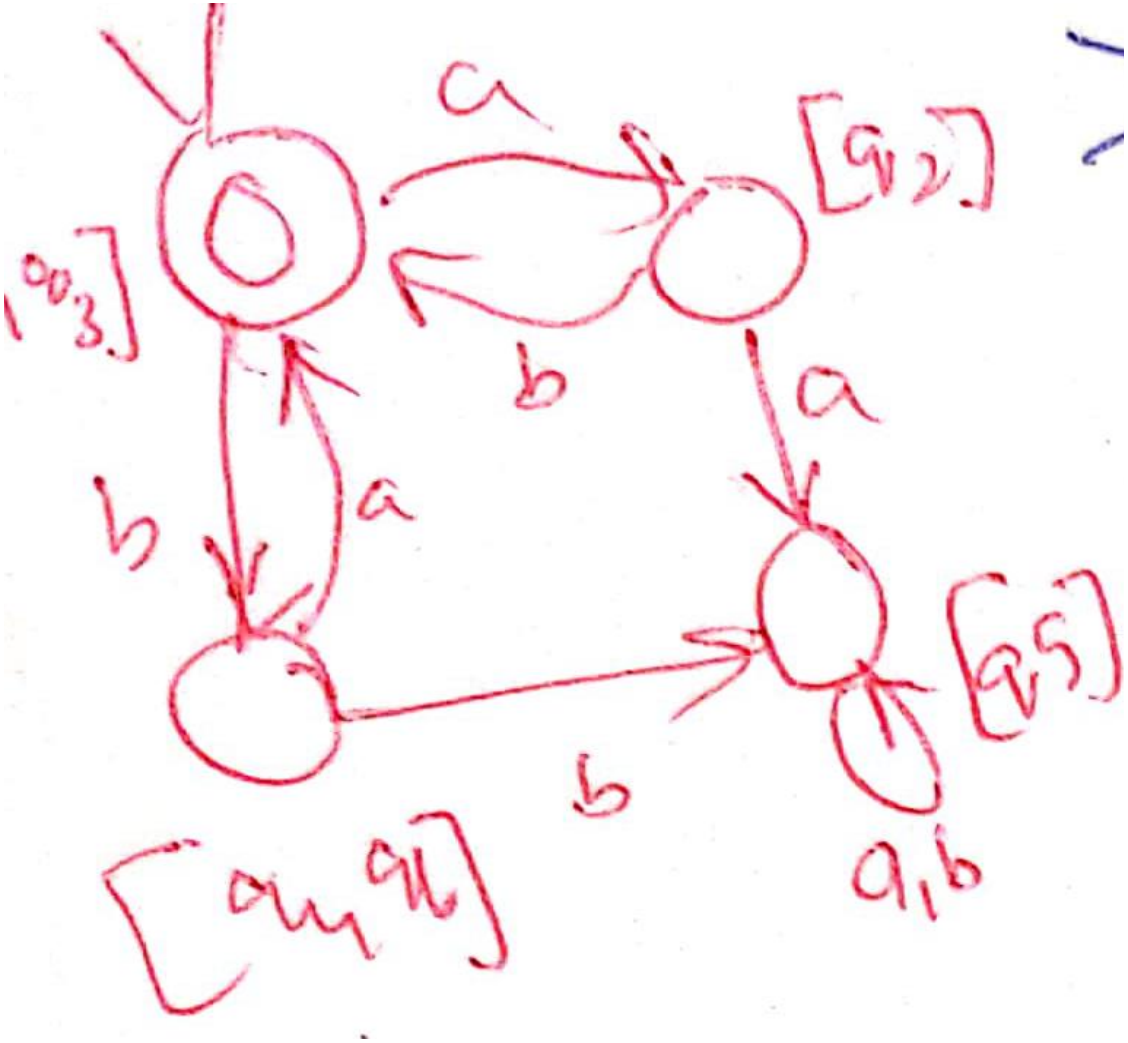
State minimization




q1
q2
q3
q4
q5
q6
a
b
a
a
b
a
b
b
a
a, b


a
[q2]
[q3]
b
a
b
a
[q5]
b
[q4 q6]
a,b

Equivalence of two states.

Two states q_i and q_j are equivalent in a DFA means that-
" From either state precisely the same strings are accepted."

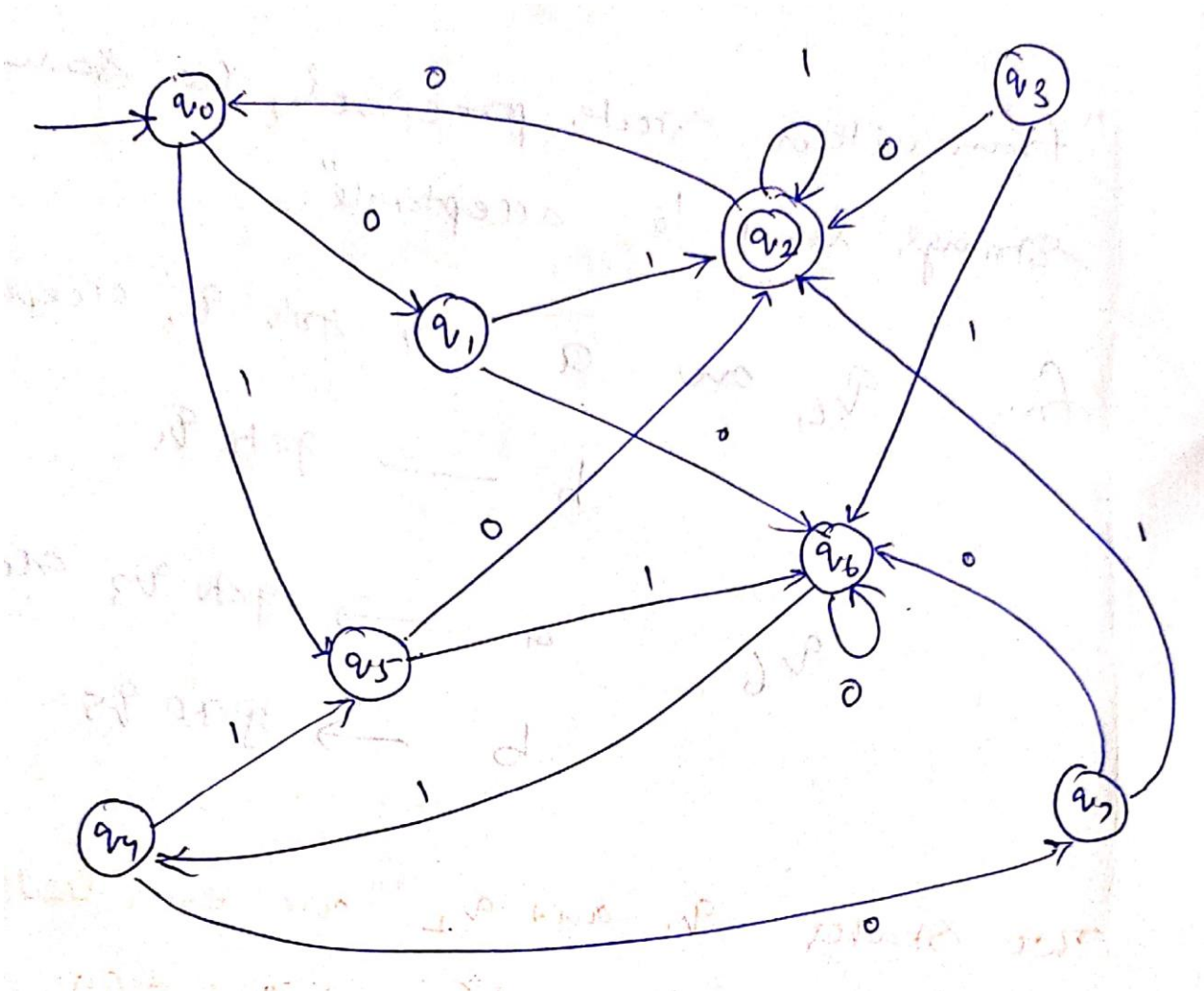
Two states q_i and q_j are equivalent $q_i \equiv q_j$ if both $\delta(q_i, x)$ and $\delta(q_j, x)$ are final states or non-final states, for all $x \in \Sigma^*$

It is difficult to check the result of $\delta(q_i, x)$ and $\delta(q_j, x)$ for all $x \in \Sigma^*$.

Two states q_i and q_j are *k-equivalent* ($k \geq 0$) $q_i \equiv q_j$ if both $\delta(q_i, x)$ and $\delta(q_j, x)$ are final states or non-final states, for all $x \in \Sigma^*$ *with length* $|x| \leq k$.

Hence any two final states are 0-equivalent.

Example

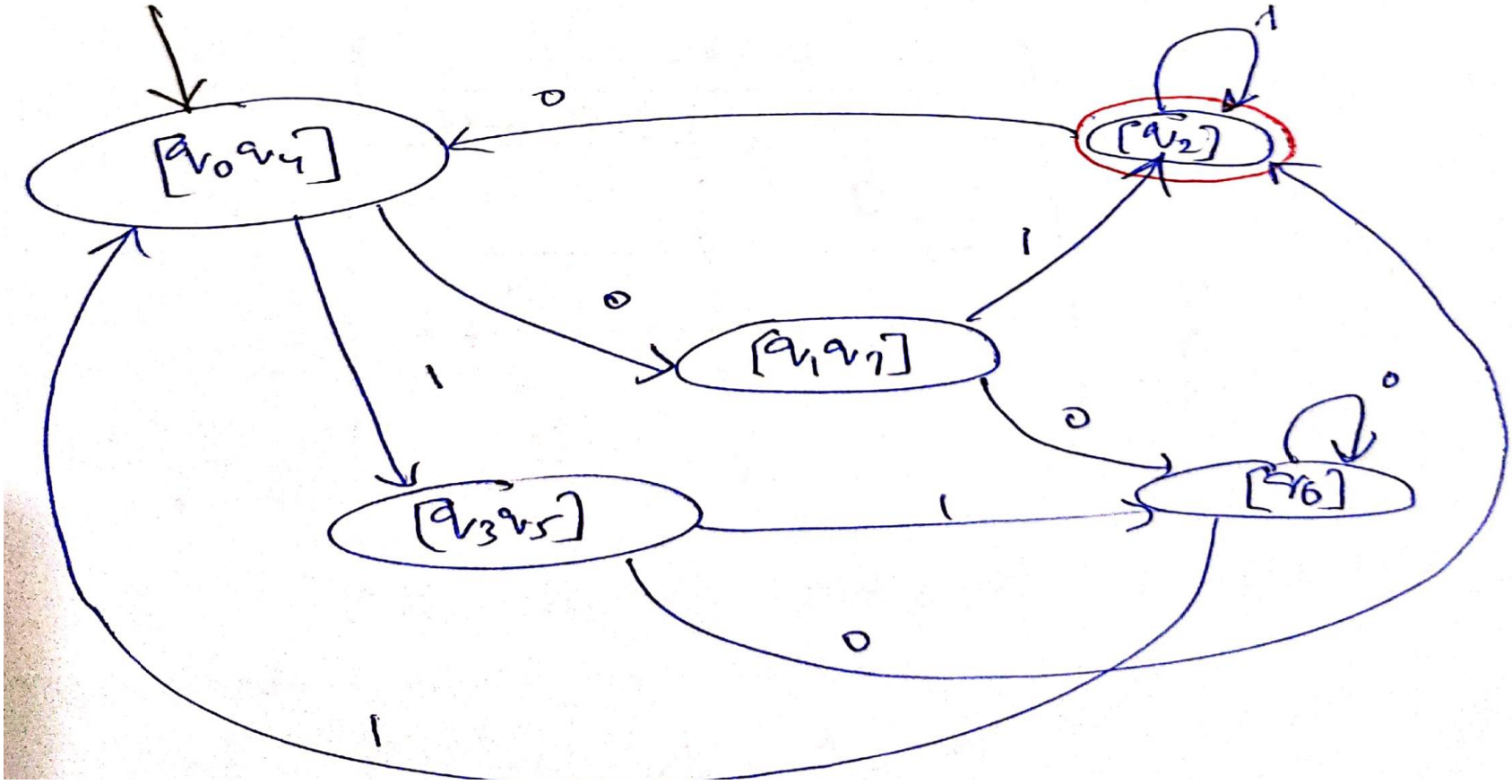


	0	1
q_0	q_1	q_5
q_1	q_6	q_2
q_2	q_0	q_2
q_3	q_2	q_6
q_4	q_7	q_5
q_5	q_2	q_6
q_6	q_6	q_4
q_7	q_6	q_2

Transition table

	0	1
$[q_0 q_4]$	$[q_1 q_7]$	$[q_3 q_5]$
$[q_1 q_7]$	$[q_6]$	$[q_2]$
$[q_2]$	$[q_0 q_4]$	$[q_2]$
$[q_3 q_5]$	$[q_2]$	$[q_6]$
$[q_6]$	$[q_6]$	$[q_0 q_5]$

Final minimal DFA



Summary of Finite Automata (Ch.2 of T1)

- What is Finite Automata (FA)
- Relationship between FA-RL-RE
- Description of FA
- Working principle of FA
- DFA
- NDFA (with and without null moves)
- Conversion from NDFA to DFA (without null moves)
- Conversion from NDFA to DFA (with null moves)
- Properties of Regular languages
- Constructing FA from RE
- Constructing RE from FA
- State Minimization in DFA