ϵ-NFA to DFA

Jacques Boillat

Department of Computer Science
Engineering and Information Technology
Berne University of applied Sciences

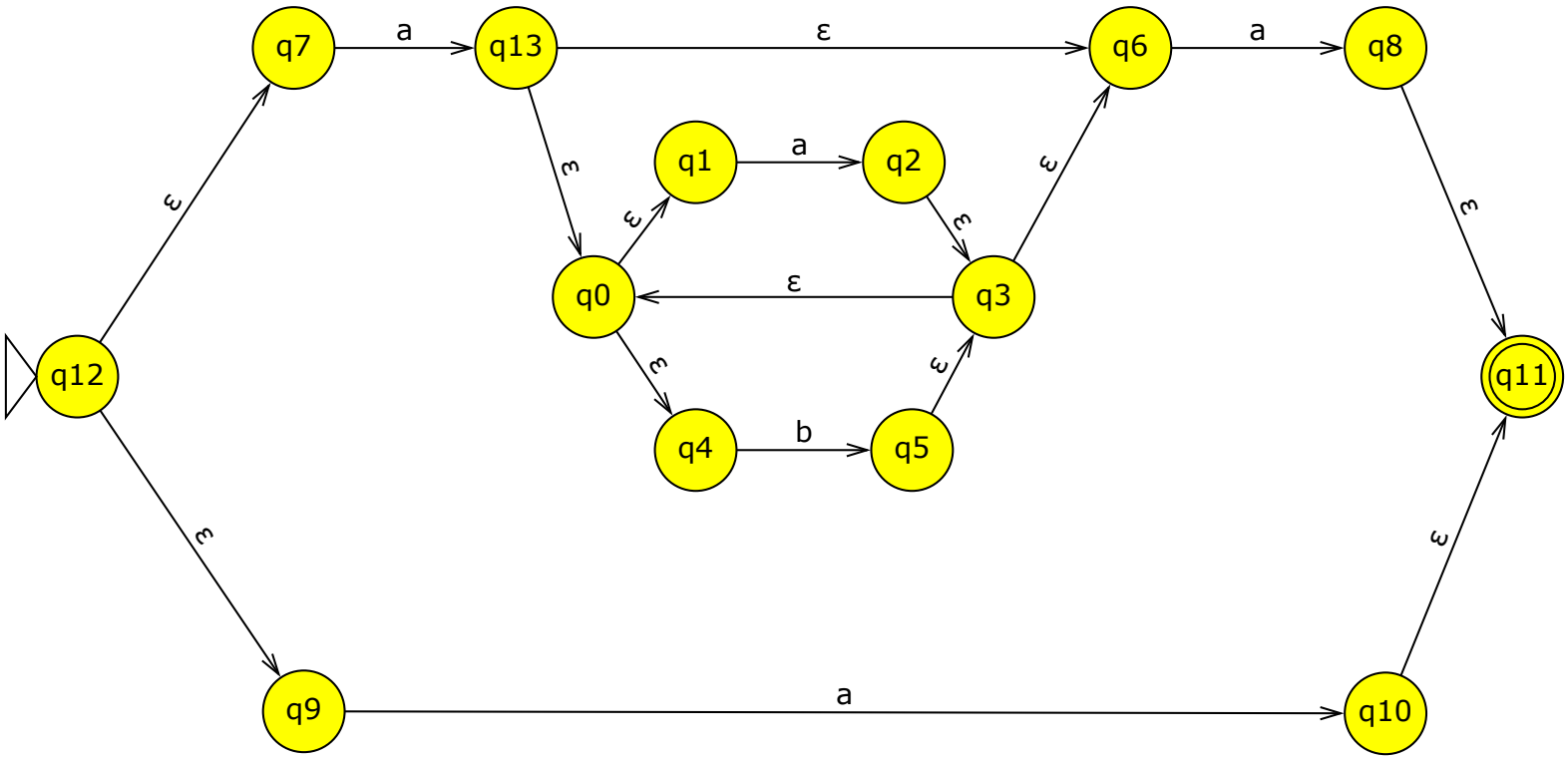
7064, WS 2010

Outline

ϵ-NFA to DFA [Outline]

The NFA [Outline]

ϵ-NFA to DFA: ϵ-NFA



ϵ-NFA to DFA: ϵ-NFA Table

	a	b	ϵ
q_0	$\varnothing$	$\varnothing$	$\{q_1, q_4\}$
q_1	$\{q_2\}$	$\varnothing$	$\varnothing$
q_2	$\varnothing$	$\varnothing$	$\{q_3\}$
q_3	$\varnothing$	$\varnothing$	$\{q_0, q_6\}$
q_4	$\varnothing$	$\{q_5\}$	$\varnothing$
q_5	$\varnothing$	$\varnothing$	$\{q_3\}$
q_6	$\{q_8\}$	$\varnothing$	$\varnothing$
q_7	$\{q_{13}\}$	$\varnothing$	$\varnothing$
q_8	$\varnothing$	$\varnothing$	$\{q_{11}\}$
q_9	$\{q_{10}\}$	$\varnothing$	$\varnothing$
q_{10}	$\varnothing$	$\varnothing$	$\{q_{11}\}$
$*q_{11}$	$\varnothing$	$\varnothing$	$\varnothing$
$\rightarrow q_{12}$	$\varnothing$	$\varnothing$	$\{q_7, q_9\}$

The Transformation [Outline]

ϵ-NFA to DFA: Transformation

We start with $\{q_7, q_9, q_{12}\} = \epsilon\textbf{Closure}(\{q_{12}\})$

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_{10}, q_{13}\}$	$\varnothing$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_{10}, q_{13}\}$	$\varnothing$
	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_2, q_8\}$	$\{q_5\}$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_2, q_8\}$	$\{q_5\}$
	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$*\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_2, q_8\}$	$\{q_5\}$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$*\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_2, q_8\}$	$\{q_5\}$
	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$*\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$\{q_0, q_1, q_3, q_4, q_5, q_6\}$	$\{q_2, q_8\}$	$\{q_5\}$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$*\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$\{q_0, q_1, q_3, q_4, q_5, q_6\}$	$\{q_2, q_8\}$	$\{q_5\}$
	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow \{q_7, q_9, q_{12}\}$	$\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\varnothing$
$*\{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$*\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$
$\{q_0, q_1, q_3, q_4, q_5, q_6\}$	$\{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$	$\{q_0, q_1, q_3, q_4, q_5, q_6$

- $A = \{q_7, q_9, q_{12}\}$
- $B = \{q_0, q_1, q_4, q_6, q_{10}, q_{11}, q_{13}\}$
- $C = \{q_0, q_1, q_2, q_3, q_4, q_6, q_8, q_{11}\}$
- $D = \{q_0, q_1, q_3, q_4, q_5, q_6\}$

ϵ-NFA to DFA: Transformation

	a	b
$\rightarrow A$	B	
$*B$	C	D
$*C$	C	D
D	C	D

The DFA [Outline]

ϵ-NFA to DFA: DFA