Homework 03 - More Deterministic Finite Automata

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1. The DFA **R1** accepts $\{\omega \mid \omega$begins with a 1 and ends with a 0$\}$:

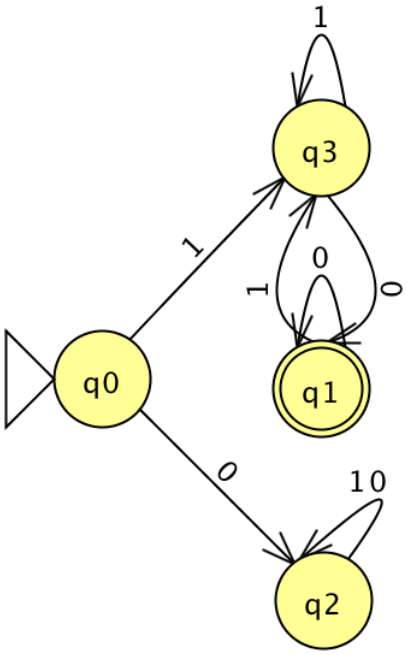

Figure 1: The R1 DFA

For R1:

(a) $Q = \{q_0, q_1, q_2, q_3\}$
(b) $\Sigma = \{0, 1\}$

(c) $\delta\colon Q \times \Sigma \to Q =$

	0	1
q_0	q_2	q_3
q_1	q_1	q_3
q_2	q_2	q_2
q_3	q_1	q_3

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_1\}$

2. The DFA **R2** accepts

   $\{\omega \mid \omega$ contains at least one 1 and an even number of 0s follow the last $1\}$:

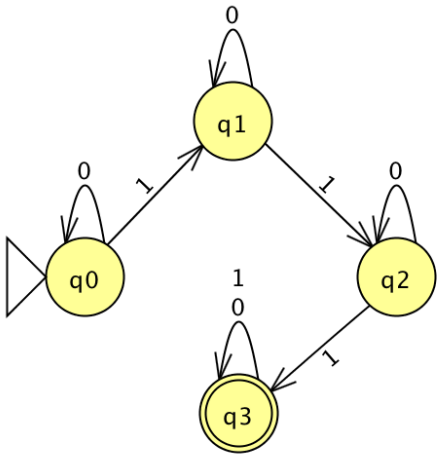

Figure 2: The R2 DFA

For R2:

(a) $Q = \{q_0, q_1, q_2, q_3\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta\colon Q \times \Sigma \to Q =$

	0	1
q_0	q_0	q_1
q_1	q_1	q_2
q_2	q_2	q_3
q_3	q_3	q_3

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_3\}$

3. The DFA **R3** accepts $\{\omega \mid \omega$ is the empty string ϵ or ends in a $0\}$:

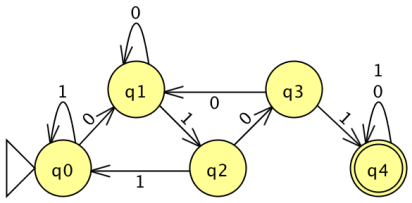

Figure 3: The R3 DFA

For R3:

(a) $Q = \{q_0, q_1, q_2, q_3, q_4\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta \colon Q \times \Sigma \to Q =$

	0	1
q_0	q_1	q_0
q_1	q_1	q_2
q_2	q_3	q_0
q_3	q_1	q_4
q_4	q_4	q_4

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_4\}$

4. The DFA **R4** accepts $\{\omega \mid \omega$ contains at least one 1 and ends with $1\}$:

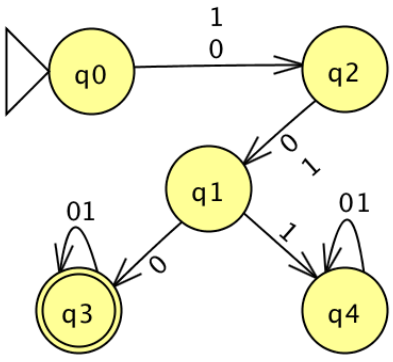

Figure 4: The R4 DFA

For R4:

(a) $Q = \{q_0, q_1, q_2, q_3, q_4\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta\colon Q \times \Sigma \to Q =$

	0	1
$q0$	$q2$	$q2$
$q1$	$q3$	$q4$
$q2$	$q1$	$q1$
$q3$	$q3$	$q3$
$q4$	$q4$	$q4$

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_3\}$

5. The DFA **R5** accepts $\{\omega \mid \omega$ starts and ends with the same symbol$\}$:

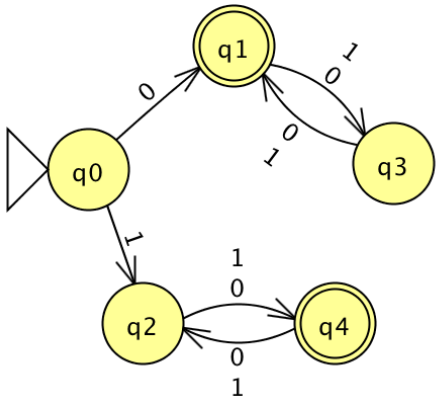

Figure 5: The R5 DFA

For R5:

(a) $Q = \{q_0, q_1, q_2, q_3, q_4\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta\colon Q \times \Sigma \to Q =$

	0	1
q_0	q_1	q_2
q_1	q_3	q_3
q_2	q_4	q_4
q_3	q_1	q_1
q_4	q_2	q_2

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_1, q_4\}$

6. The DFA **R6** accepts $\{\omega \mid \omega\text{contains a substring } 001\}$:

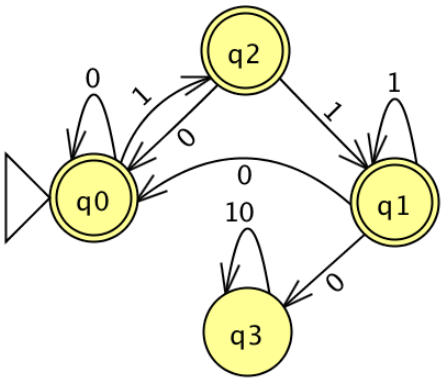

Figure 6: The R6 DFA

For R6:

(a) $Q = \{q_0, q_1, q_2, q_3\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta\colon Q \times \Sigma \to Q =$

	0	1
q_0	q_0	q_2
q_1	q_0	q_1
q_2	q_0	q_1
q_3	q_3	q_3

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_0, q_1, q_2\}$

7. The DFA **R7** accepts tuples of the form (front door switch state, rear door switch state):

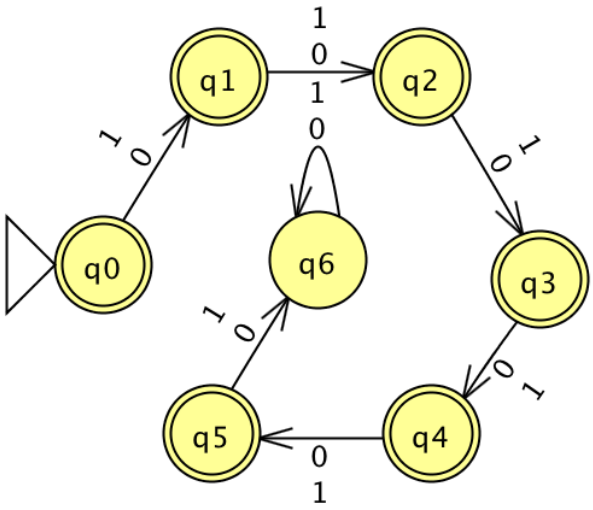

Figure 7: The R6 DFA

For R7:

(a) $Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}$

(b) $\Sigma = \{0, 1\}$

(c) $\delta \colon Q \times \Sigma \to Q =$

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

(d) q_0 (the start state) $= q_0 \in Q$

(e) $F = \{q_0, q_1, q_2, q_3, q_4, q_5\}$