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Course Code: COMP3602
Course Title: Theory of Computing
Assignment: 1

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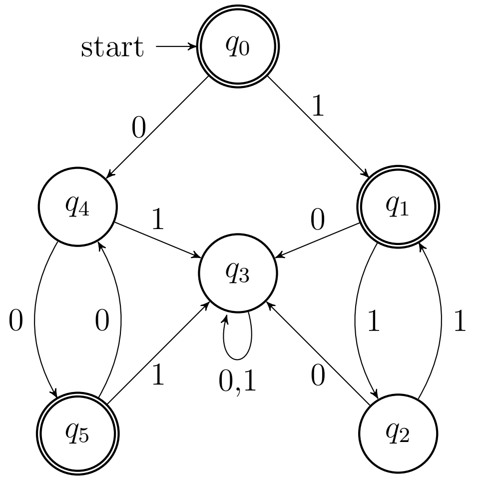
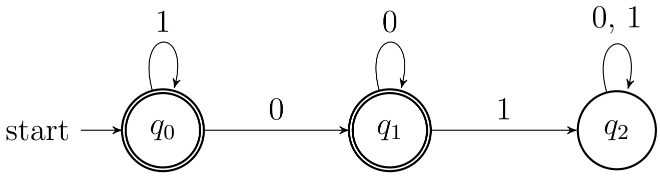
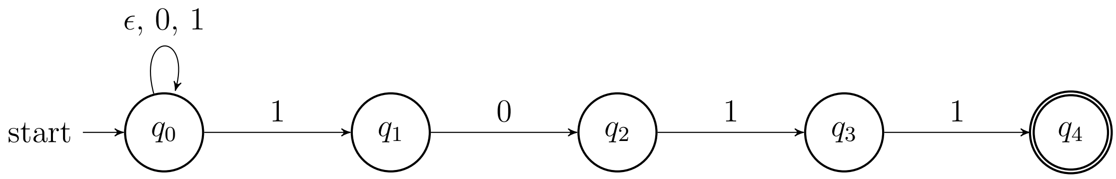
1. (a) $\{0^n \vee 1^m \mid n \text{ is even}, m \text{ is odd}\}$



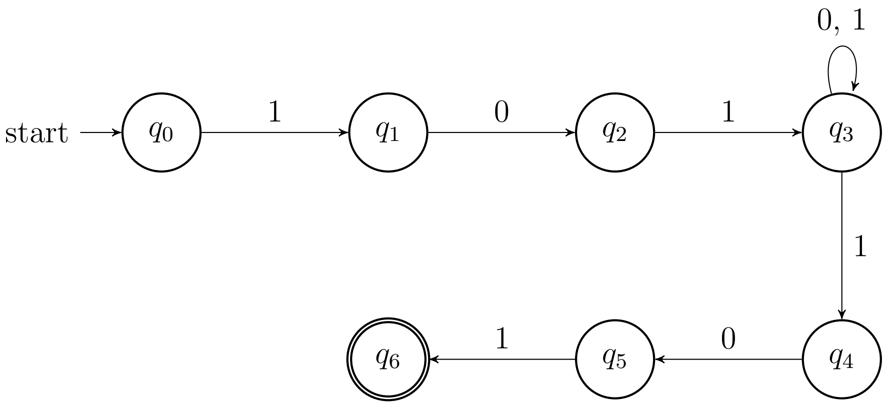
(b) Any string that does not contain the substring 01



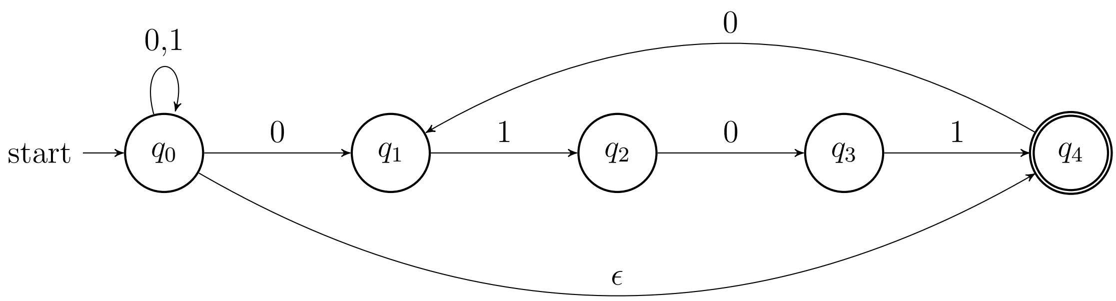
2. (a) Strings ending in 1011



(b) $\{101x101 \mid x \in \Sigma^*\}$



(c) $\{x(ab)^n \mid x \in \Sigma^* \, n \text{ is even}\}$



3. Let us refer to the DFA in Question 1b as M. Then $M = \{\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, \{q_0, q_1\}\}$ where δ is given by:
$\delta(q_0, 0) = q_1$
$\delta(q_0, 1) = q_0$
$\delta(q_1, 0) = q_1$
$\delta(q_1, 1) = q_2$
$\delta(q_2, 0) = q_2$
$\delta(q_2, 1) = q_2$

4. Let us refer to the NFA in Question 2b as N. Then $N = \{\{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}, \{0, 1\}, \delta, q_0, \{q_6\}\}$ where δ is given by:
$\delta(q_0, 0) = \{\}$
$\delta(q_0, 1) = \{q_1\}$
$\delta(q_0, \epsilon) = \{\}$
$\delta(q_1, 0) = \{q_2\}$
$\delta(q_1, 1) = \{\}$
$\delta(q_1, \epsilon) = \{\}$
$\delta(q_2, 0) = \{\}$
$\delta(q_2, 1) = \{q_3\}$
$\delta(q_2, \epsilon) = \{\}$
$\delta(q_3, 0) = \{q_3\}$
$\delta(q_3, 1) = \{q_3, q_4\}$
$\delta(q_3, \epsilon) = \{\}$
$\delta(q_4, 0) = \{q_5\}$
$\delta(q_4, 1) = \{\}$
$\delta(q_4, \epsilon) = \{\}$
$\delta(q_5, 0) = \{\}$
$\delta(q_5, 1) = \{q_6\}$
$\delta(q_5, \epsilon) = \{\}$
$\delta(q_6, 0) = \{\}$
$\delta(q_6, 1) = \{\}$
$\delta(q_6, \epsilon) = \{\}$

5.

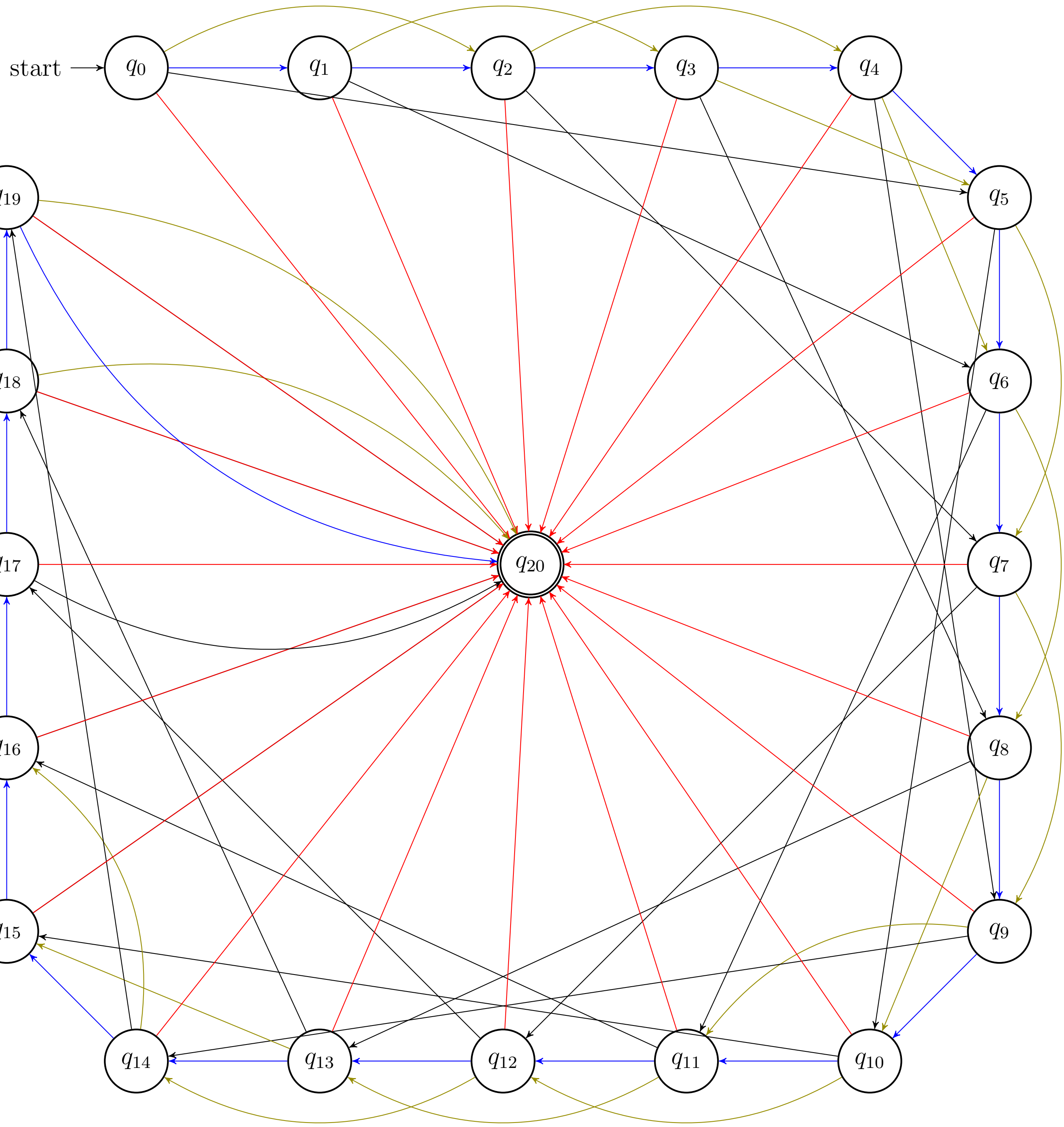
Key/Legend:

→ \$0.05

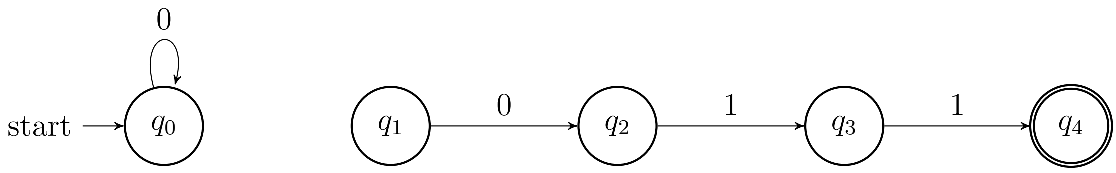
→ \$0.10

→ \$0.25

→ \$1.00



6.



7. $\mathscr{L}_1 - \mathscr{L}_2$ can be expressed as $(\mathscr{L}_1 \bigcup \mathscr{L}_2) \bigcap \overline{\mathscr{L}_2}$, assuming they are within the same universal set. This defines set difference in terms of intersection, union and complement, for which the regular languages are known to be regular. Thus it can be concluded that $\mathscr{L}_1 - \mathscr{L}_2$ is a regular language.

8.

9.

Regular Expression	**Recognized Strings**	**Non-Recognized Strings**
a^*b^*	ϵ	aba
	ab	baa
$a(ba)^*bb$	abb	ϵ
	ababb	bababb
$a^+ \cup b^*$	bb	ab
	a	bab
$(\epsilon \cup a)b$	b	ϵ
	ab	bb