CISS362: Introduction to Automata Theory, Languages, and Computation
Assignment a06

Name: _____

Objectives

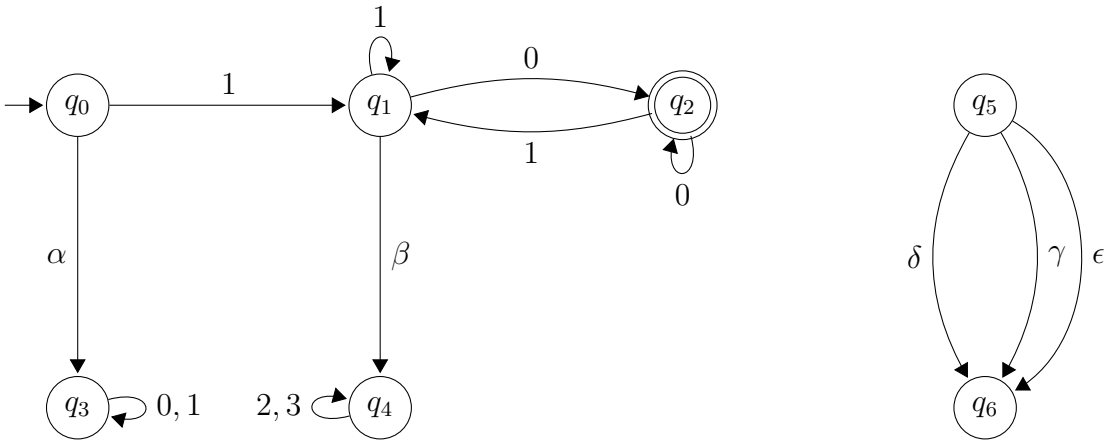
- Design DFAs
- Design NFAs.

As before modify the files `q01.tex` for Q1, `q02.tex` for Q2, etc. Tar and gzip your directory and email to `yliow.submit@gmail.com` using your college email account. Use subject line "`ciss362 a06`".

- Sipser 1.17. Q1
- Sipser 1.18. Q2. Solutions for (a)-(d) provided.
- Sipser 1.19. Q3
- Sipser 1.20. DIY. First solve it (use simplest examples). Then check the solution below.
- Sipser 1.21. Q4
- Sipser 1.22. Q5
- Sipser 1.23. Try it first. Then study the solution in the book.
- Sipser 1.28. Q6
- Sipser 1.31. Q7

How to draw a state diagram

Here's an example showing you how to draw the elements of a state diagram. Also, look at the solution to 1.3 below.



For more information on drawing state diagrams go to my tutorials and look for `latex-automata.pdf`:

https://drive.google.com/file/d/1AeE-P0WNvQlitzPDxQpGE8bMR9Yc9gMW

Let me know if you have any questions about drawing state diagram.

Q1. Sipser 1.17.

(a) Design an NFA N that accepts the language $\{01, 001, 010\}^*$.
(b) Convert N to an equivalent DFA using the powerset construction.

Solution.

Q2. Sipser 1.18. Solutions for (a)-(d) provided.

Write down regular expressions generating the following languages where $\Sigma = \{0, 1\}$

(a) $\{w \mid w$ begins with 1 and ends with $0\}$
(b) $\{w \mid w$ contains at least three 1s$\}$
(c) $\{w \mid w$ contains sbstring 0101$\}$
(d) $\{w \mid w$ has length at least 3 and its third symbol is a $0\}$
(e) $\{w \mid w$ start with 0 and has odd length, or starts with 1 and has even length$\}$
(f) $\{w \mid w$ does not contain the substring 110$\}$
(g) $\{w \mid$ the length of w is at most $5\}$
(h) $\{w \mid w$is any string except 11 and 111$\}$
(i) $\{w \mid$ every odd position of w is a $1\}$
(j) $\{w \mid w$ contains at least two 0s and at most one 1$\}$
(k) $\{\epsilon, 0\}$
(l) $\{w \mid w$ contains an even number of 0, or contains exactly two 1s$\}$
(m) $\{\}$
(n) $\{w \mid w \neq \epsilon\}$

Solution.

(a) Solution provided: $1(0 \cup 1)^*0$

(b) Solution provided: $(0 \cup 1)^*1(0 \cup 1)^*1(0 \cup 1)^*1(0 \cup 1)^*$

(c) Solution provided: $(0 \cup 1)^*0101(0 \cup 1)^*$

(d) Solution provided: $(0 \cup 1)(0 \cup 1)0(0 \cup 1)^*$

Q3. Sipser 1.19.

Solution.

Solution to Sipser 1.20:

(a) Members: ϵ, ab. Nonmembers: ba, bab.
(b) Members: ab, $abab$. Nonmembers: ϵ, a.
(c) Members: ϵ, a. Nonmembers: ab, ba.
(d) Members: ϵ, aaa. Nonmembers: a, b.
(e) Members: aba, $aaba$. Nonmembers: ϵ, a.
(f) Members: aba, bab. Nonmembers: ϵ, a.
(g) Members: b, ab. Nonmembers: ϵ, a.
(h) Members: a, ab. Nonmembers: ϵ, b.

Q4. Sipser 1.21.

Solution.

Q5. Sipser 1.22.

Solution.

Q6. Sipser 1.28.

Solution.

Q7. Sipser 1.31.

Suppose $L = L(M)$ where $M = (\Sigma, Q, q_0, F, \delta)$.

(a) Describe informally how to design a DFA that accepts L^R.
(b) Describe formally a DFA, M^R, such that $L(M^R) = L^R$.

Solution.

(a)

(b)

(c)