2110355 Formal Language and Automata Theory Homework#2

1. Exercise 4.2

An NFA with states 1-5 and input alphabet {a,b} has the following transition table.

q	δ(q,a)	δ(q,b)
1	{1,2}	{1}
2	{3}	{3}
3	{4}	{4}
4	{5}	Ø
5	Ø	{5}

a. Draw a transition diagram.
b. Calculate $\delta^*(1,ab)$.
c. Calculate $\delta^*(1,abaab)$.

2. Exercise 4.10 (e)

Part e of Figure 4.20 is pictured an NFA. Using the subset construction, draw an FA accepting the same language. Label the final picture so as to make it clear how it was obtained from the subset construction.

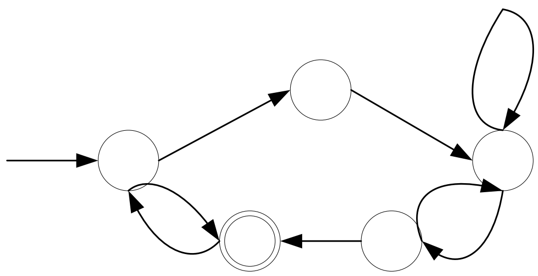

Figure 4.20 (e)

3. Exercise 4.11

After the proof of Theorem 3.4, we observed that if $M = (Q,\Sigma,q_0,A,\delta)$ is an FA accepting L, then the FA $M' = (Q,\Sigma,q_0,Q-A,\delta)$ accepts L'. Does this still work if M is an NFA? If so, prove it. If not explain why, and find a counterexample.

4. Exercise 4.15 (c)

For part c of the NFA- Λs shown in Figure 4.22, find a regular expression corresponding to the language it recognizes.

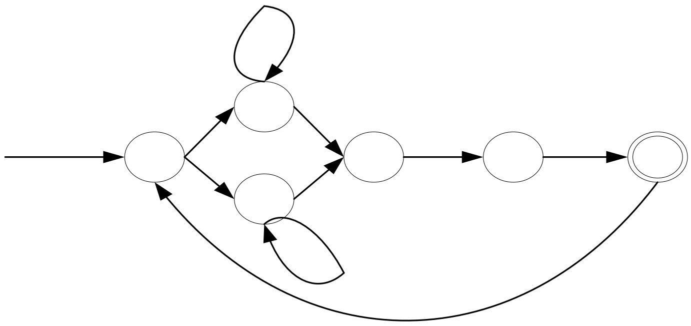

Figure 4.22 (c)

5. Exercise 4.25

Suppose M = (Q,Σ,q_0,A,δ) is an NFA-Λ recognizing a language L. Let M_1 be the NFA- Λ obtained from M by adding Λ -transitions from each element of A to q_0. Describe (in terms of L) the language L(M_1).

6. Exercise 4.26 (b)

Suppose M = (Q,Σ,q_0,A,δ) is an NFA-Λ recognizing a language L.

b. Describe how to construct an NFA-Λ M_2 with exactly one accepting state and no transitions from that state so that M_2 also recognizes L.

7. Exercise 4.29 (c)

In **Part c of Figure 4.24** is pictured an NFA- Λ. Draw an FA accepting the same language.

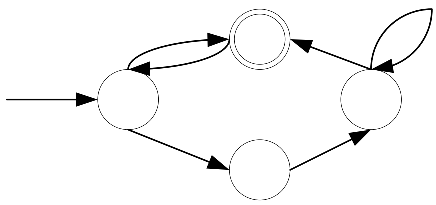

Figure 4.24 (c)

8. Exercise 4.44 (a)

Let M = (Q,Σ,q_0,A,δ) be an NFA- Λ recognizing a language L. Assume that there are no transitions to q_0, that A has only one element, q_f, and that there are no transitions from q_f.

a. Let M_1 be obtained from M by adding Λ-transitions from q_0 to every state that is reachable from q_0 in M. (If p and q are states, q is reachable from p if there is a string x ϵ Σ* such that q ϵ δ*(p,x).) Describe (in terms of L) the language accepted by M_1

9. Exercise 5.23 (d)

In part d of Exercise 5.20, use the pumping lemma for regular languages to show that the language is not regular.

$L = \{0^i 1^j \mid j \text{ is a multiple of } i\}$ (Part d from Exercise 5.20)

10. Exercise 5.23 (b)

In part b of Exercise 5.20, use the pumping lemma for regular languages to show that the language is not regular.

$L = \{0^i 1^j 0^k \mid k > i+j\}$ (Part b from Exercise 5.20)

11. Exercise 5.24 (a)

Use the pumping lemma to show that this language is not regular:

a. $L = \{ww \mid w \in \{0,1\}^*\}$

12. Exercise 5.26 (a)

For statement below, decide whether it is true of false. If it is true, prove it. If not, give a counterexample. All parts refer to languages over the alphabet $\{0,1\}$.

If $L_1 \subseteq L_2$ and L_1 is not regular, then L_2 is not regular.

13. Exercise 5.26 (e)

For statement below, decide whether it is true of false. If it is true, prove it. If not, give a counterexample. All parts refer to languages over the alphabet $\{0,1\}$.

If L is nonregular, then L' is nonregular.

14. Exercise 5.26 (g)

For statement below, decide whether it is true of false. If it is true, prove it. If not, give a counterexample. All parts refer to languages over the alphabet $\{0,1\}$.

If L_1 is regular, L_2 is nonregular, and $L_1 \cap L_2$ is regular, then $L_1 \cup L_2$ is nonregular.

15. Exercise 5.27 (c)

A number of languages over $\{0,1\}$ are given in statement below. Decide whether the language is regular or not, and prove that your answer is correct.

The set of odd-length strings over $\{0,1\}$ with middle symbol 0.