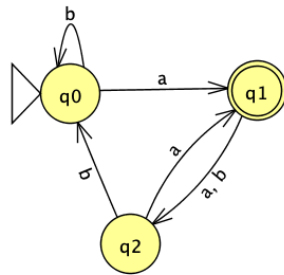


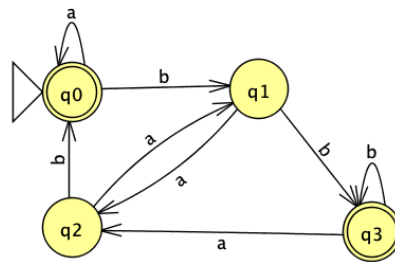
COMP2321-Formal Languages and Finite Automata

Worksheet 1

Exercise 1. The following are the state diagrams of two DFAs, M_1 and M_2 . Answer the following questions about each of these machines.



(a) M_1



(b) M_2

- What is the start state?
- What is the set of accept states?
- What sequence of states does the machine go through on input $aabb$?
- Does the machine accept the string $aabb$?
- Does the machine accept the string ϵ ?

Exercise 2. Give the formal description of the machines M_1 and M_2 pictured in Exercise 1.

Exercise 3. The formal description of a DFA M is $(\{q_1, q_2, q_3, q_4, q_5\}, \{u, d\}, \delta, q_3, \{q_3\})$, where δ is given by the following table. Give the state diagram of this machine.

δ	u	d
q_1	q_1	q_2
q_2	q_1	q_3
q_3	q_2	q_4
q_4	q_3	q_5
q_5	q_4	q_5

Exercise 4. Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them using the construction discussed in footnote 3 (page 46) of the textbook, to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{a, b\}$.

- $\{w \mid w \text{ has exactly 2 a's and at least 2 b's}\}$.

- b) $\{w \mid w \text{ has an even number of } a\text{'s and each } a \text{ is followed by at least one } b\}$

Exercise 5. Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{a, b\}$.

- a) $\{w \mid w \text{ does not contain } ab\}$.
b) $\{w \mid w \text{ does not contains } baba\}$.

Extra Exercises

Exercise 6. Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them using the construction discussed in footnote 3 (page 46) of the textbook, to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{a, b\}$.

- a) $\{w \mid w \text{ has at least three } a\text{'s and at least two } b\text{'s}\}$.
b) $\{w \mid w \text{ has an even number of } a\text{'s and one or two } b\text{'s}\}$.
c) $\{w \mid w \text{ starts with an } a\text{'s and has at most one } b\text{'s}\}$.
d) $\{w \mid w \text{ has an odd number of } a\text{'s's and ends with a } b\text{'s}\}$.
e) $\{w \mid w \text{ has even length and an odd number of } a\text{'s's}\}$.

Exercise 7. Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{a, b\}$.

- a) $\{w \mid w \text{ is any string not in } a^*b^*\}$.
b) $\{w \mid w \text{ is any string not in } (ab^+)^*\}$.
c) $\{w \mid w \text{ is any string except } a \text{ and } b\}$