

• Solve the following problems before the Tutorial.

1. Two DFAs, M_1 and M_2 are given below. Answer the following questions for each of these machines.

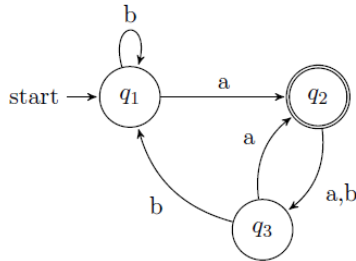


Figure 1: M_1

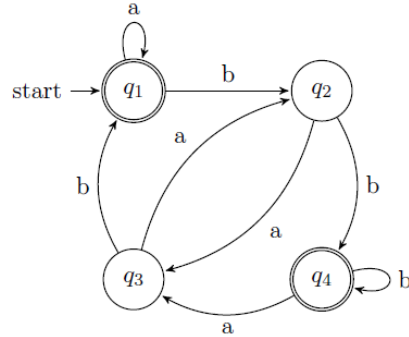


Figure 2: M_1

- (a) What is the start state?
 - (b) What is the set of accept states?
 - (c) What sequence of states does the machine go through on input $aabb$?
 - (d) Does the machine accept the string $aabb$?
 - (e) Does the machine accept the string ϵ ?
2. 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.

	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

3. Construct and give the state diagram of DFAs for the following given languages.
In all parts $\Sigma = \{a, b\}$.

- (a) $\{w \mid w \text{ has at least three } a\text{'s}\}$
 - (b) $\{w \mid w \text{ has exactly two } b\text{'s}\}$
 - (c) $\{w \mid w \text{ contains substring } ba\}$
 - (d) $\{w \mid w \text{ does not contain substring } abab\}$
 - (e) $\{w \mid w \text{ is any string except } a \text{ and } b\}$
4. Give state diagrams of DFAs recognizing the following languages.
In all parts the alphabet $\Sigma = \{0, 1\}$.
- (a) $\{w \mid w \text{ begins with a } 1 \text{ and ends with a } 0\}$
 - (b) $\{w \mid w \text{ contains the substring } 0101, \text{ i.e., } w = x0101y \text{ for some } x \text{ and } y\}$
 - (c) $\{w \mid w \text{ does not contain the substring } 110\}$

- (d) $\{ w \mid \text{every odd position of } w \text{ is a } 1 \}$
- (e) $\{\epsilon, 0\}$

5. Construct and give the state diagram of NFAs for the following given languages.

- (a) Set of all string in $\{0,1\}$ which are the binary representation of integers divisible by 2.
- (b) Set of strings consisting all strings over $\{0,1\}$ starts and ends with same symbol.
- (c) Set of strings consisting all strings over $\{0,1\}$ does not start and end with same symbol.
- (d) Set of strings consisting all strings over $\{0\}$ of the form 0^k , for k is even.
- (e) Set of strings consisting all strings over $\{0\}$ of the form 0^k , for k is even and not divisible by 3.
- (f) Set of strings consisting all strings over $\{0,1\}$ containing an 1 in the 2nd position from end.
- (g) Set of strings over $\{0,1\}$ of length either divisible by 2 or 3.

6. Prove that if $M_1 = \{Q, \sum, \delta, q_0, F\}$ is a DFA recognizes a language A , Then $M_1 = \{Q, \sum, \delta, q_0, Q \setminus F\}$ recognizes A^c .