

# B.tech. IV Sem (CSE), 2018-19

## Theory of Computation, Assignment # 1

January 21, 2019

### Attempt any five questions.

1. Define a Finite Automaton. How you justify a modern computer as a Finite Automata.
2. Describe the application of FA in building Lexical Analyzer for compilers.
3. Why a FA is deterministic? Justify your answer.
4. For the alphabet set  $\Sigma = \{a, b\}$  construct DFAs for each of the following languages.
  - (a) All strings with exactly one  $a$ .
  - (b) All strings with at least one  $a$ .
  - (c) All strings with no more than three  $b$ 's.
5. Describe the language accepted by the automaton corresponding to the transition diagram given in figure 1. Also, give its regular expression.

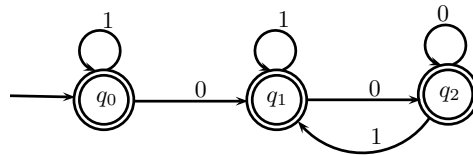


Figure 1: DFA.

6. Construct the deterministic finite automaton for each of the following languages:
  - (a)  $\{w \mid w \in \{a, b\}^* \text{ and length of } w \text{ is greater than } 3\}$ .
  - (b)  $\{w \mid w \in \{a, b\}^* \text{ and every run of } a \text{ has even length}\}$ .
  - (c)  $\{w \mid w \in \{a, b\}^* \text{ and number of } a\text{'s and } b\text{'s are even in } w\}$ .
7. Find the finite automata for each of the following regular expressions:
  - (a)  $aa^*bb^*cc^*$
  - (b)  $(aba^*ba^*b)^*$
  - (c)  $a^*b + (b^*a)^*$
  - (d)  $(aaa)^*b + (aa)^*b$
8. Show that for a DFA, for every  $q \in Q$ ,  $a \in \Sigma$ ,  $\delta(q, a) = q$ , prove that  $\delta^*(q, x) = q$ , for every  $x \in \Sigma^*$ .
9. Show that there cannot be a DFA of less than four states which can recognize the language,
$$\{w \in \{a, b\}^* \mid w \text{ contains even number of } a\text{'s and } b\text{'s}\}.$$
10. For  $x, y \in \Sigma^*$ , prove that for any DFA  $\delta(q, xy) = \delta(\delta(q, x), y)$ , where  $\delta$  is transition function.
11. Design a finite automaton for controller for a swing door with a front pad and rear pad. There are two states corresponding to door on and closed, and four possible inputs: front, rear, neither, and both.

**Submission deadline: 28-01-2019. Write your by hand on A4 or register paper, and then scan and submit through ERP**