

TUTORIAL 4
FINITE AUTOMATA
DUE DATE: 19th DECEMBER 2019

1. Construct a state transition diagram of a DFA that accepts all strings over $\{a, b, c\}$ that begin with a , contain exactly two b 's, and end with c .
2. Construct a state transition diagram of a DFA that accepts the given set of strings over $\{0, 1\}$:
 - a) contain the substring 00 or 11.
 - b) begin AND end with 00.
 - c) begin OR end with 00.
3. Construct a state transition diagram of a FSM that accepts the given set of strings over $\{a, b\}$:
 - a) contain exactly two b 's.
 - b) at least one b .
 - c) odd number of a 's
4. Suppose that a language, L , is a C programming language style comment such that $L = \{ w \mid w \text{ is a C-style comment} \}$ with input alphabet, $\Sigma = \{ a, b, c, \dots, z, *, / \}$. Examples of accepted and rejected strings are shown in Table 1:

Table 1

| Accepted Strings | Rejected Strings |
|------------------|------------------|
| $/*abcz*/$ | $/**$ |
| $/**/$ | $/**/bca/*aaz*/$ |
| $/***/$ | $aab/**/$ |
| $/*abc*xyz*/$ | $/*$ |
| $/*a/b*/$ | $/ab*/$ |

Design a DFA that accepts language, L .

5. A description of an automatic telephone answering machine is shown in Table 2. When a call arrives, the phone rings. If the phone is not picked up, then on the third ring, the machine answers. It plays a pre-recorded greeting requesting that the caller leave a message, then records the caller's message, and then automatically hangs up. If the phone is answered before the third ring, the machine does nothing.

Table 2

| States | | Input | | Output | |
|--------|------------------------------|-------|------------------------------------|--------|---|
| q_0 | idle (nothing is happening) | i_1 | incoming ringing signal | 0 | default output when there is nothing interesting to say |
| q_1 | one ring has arrived | i_2 | a telephone is picked up | 1 | answer the phone and start the greeting message |
| q_2 | two rings have arrived | i_3 | greeting message is finish playing | 2 | start recording the incoming message |
| q_3 | playing the greeting message | i_4 | end of message detected | 3 | recorded an incoming message |
| q_4 | recording the message | i_5 | no input of interest | | |

a) Construct a state transition table by completing table below.

| | f_s | | | | | f_o | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | i_1 | i_2 | i_3 | i_4 | i_5 | i_1 | i_2 | i_3 | i_4 | i_5 |
| q_0 | | | | | | | | | | |
| q_1 | | | | | | | | | | |
| q_2 | | | | | | | | | | |
| q_3 | | | | | | | | | | |
| q_4 | | | | | | | | | | |

b) Based on answer in (a), construct a state transition diagram for the telephone answering machine.