

SECI1013 – DISCRETE STRUCTURE
ASSIGNMENT 4
DEADLINE 30 JANUARY 2022

1. Let $M = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{a, b, c, d\}, q_0, f_s, \{q_4, q_5\})$ be the Deterministic Finite Automaton (DFA) with state transition function, f_s defined as follows:

$f(q_0, a) = q_1$	$f(q_0, b) = q_3$	$f(q_0, c) = q_2$	$f(q_0, d) = q_3$
$f(q_1, a) = q_1$	$f(q_1, b) = q_4$	$f(q_1, c) = q_1$	$f(q_1, d) = q_1$
$f(q_2, a) = q_2$	$f(q_2, b) = q_2$	$f(q_2, c) = q_2$	$f(q_2, d) = q_5$
$f(q_3, a) = q_3$	$f(q_3, b) = q_3$	$f(q_3, c) = q_3$	$f(q_3, d) = q_3$
$f(q_4, a) = q_1$	$f(q_4, b) = q_4$	$f(q_4, c) = q_1$	$f(q_4, d) = q_1$
$f(q_5, a) = q_2$	$f(q_5, b) = q_2$	$f(q_5, c) = q_2$	$f(q_5, d) = q_5$

- i. Draw the transition diagram for the machine, M .
 - ii. Describe the set of strings that accepted by M .
2. Construct a state transition diagram of a DFA that accepts all strings over $\{x, y, z\}$ that begin with x , contain exactly four y 's, and end with zz .
3. Construct a state transition diagram of a DFA that accepts all string over $\{U, T, M, 0, 1, 2\}$ that contain string '22' or 'UTM'.
4. Construct a state transition diagram of a DFA that accepts all string over $\{a, b, \dots, z, 0, 1, \dots, 9\}$ that start with a digit (0-9), contain string 'utm50' and end with a letter ($a-z$).
5. Based on the state diagram in Figure 1,
- i. Construct its state transition table for the finite-state machine (FSM).
 - ii. Write the output string for the input string of 00001.
 - iii. State whether the input string in (b) is accepted by M or not.

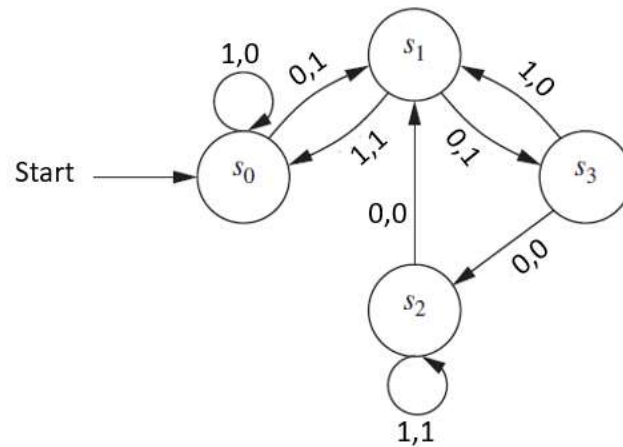


Figure 1

6. Given a unidirectional controller for a sanitizer booth. It has 2 doors, a button for entrance and a pressure sensor to spray the sanitizer. Assume each operation takes one clock cycle.
 - i. The booth should do nothing until it receives its inputs.
 - ii. If a person presses the button, the entrance door 1, D1 should open to admit the person and then close again.
 - iii. If a person is detected in the booth, the spray will go on. Otherwise, the booth should do nothing.
 - iv. Once the sanitizing is finished, the second door, D2 should be opened.
 - v. Once the person has left, the door D2 should close again.

Construct a finite state machine that models this sanitizer booth.

7. A Full Adder accepts two input bits and an input carry and generates a sum and carry at its output side (refer to Table 1). Two or more full adders can be connected in parallel to perform binary addition operation for more than 2 bits. The input bits and input carry are denoted as A, B and C_{in} respectively. Construct a finite state machine that represents the addition.

Table 1

A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1