SECI1013:DISCRETE STRUCTURE
SESSION 2025/2026 SEMESTER 1

ASSIGNMENT4 (FINITE AUTOMATA)

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INSTRUCTIONS:

i. This assignment must be conducted in group. Please clearly write the group member's names & matric numbers on the front page of the submission.

ii. Solutions for each question must be readable and neatly written on plain A4 paper or digitally written. Every step or calculation should be properly shown. Failure to do so will result in the rejection of the submission of the assignment.

iii. This assignment consists of 5 questions (35 marks), contributing 5 % of overall course marks.

QUESTION 1 [10 Marks]

Let M = ({q0, q1, q2, q3, q4, q5}, {a, b, c}, q0, fs, {q1, q3, q5}) be the Deterministic Finite Automaton (DFA) with state transition function, fs defined as follows:

f (q0, a) = q1	f (q0, b) = q0	f (q0, c) = q0
f (q1, a) = q1	f (q1, b) = q2	f (q1, c) = q1
f (q2, a) = q2	f (q2, b) = q3	f (q2, c) = q4
f (q3, a) = q3	f (q3, b) = q3	f (q3, c) = q3
f (q4, a) = q4	f (q4, b) = q5	f (q4, c) = q4
f (q5, a) = q5	f (q5, b) = q5	f (q5, c) = q5

a. Draw the transition table for the above machine (6 marks)
b. Determine the final state for the input string abcc. (2 marks)
c. Is the input string abcb accepted by the DFA? (2 marks)

QUESTION 2 [5 Marks]

Suppose that a language, L, is a C programing language style comment such that L = { w | w is a C-style comment} with input alphabet, Σ={ a, b, c, …, z, * , / }. Examples of accepted and rejected strings are shown in Table 1. Design a DFA that accepts language, L.

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Table 1

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

QUESTION 3 [5 Marks]

Construct the state transition table for the Finite State Machine (FSM) defined by the transition diagram shown in Figure 1. Then find the output string for the input string 101011.

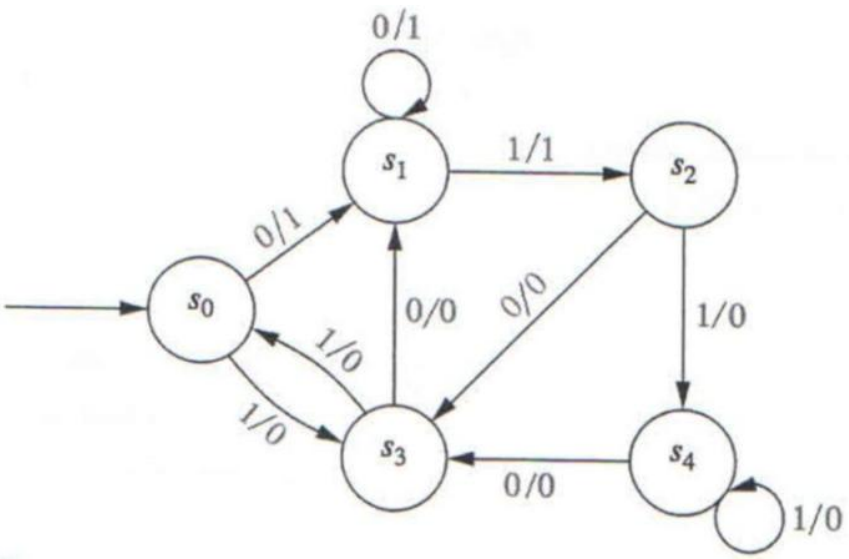

Figure 1

QUESTION 4 [5 Marks]

Construct a state transition diagram of a FSM that accepts the given set of strings over {a, b} at least one b.

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QUESTION 5 [10 Marks]

A hypermarket with two floors is equipped with an elevator to assist customers during their shopping. The elevator serves two levels: the ground floor and the first floor. Its operation is controlled by a single button that has two possible commands: Up and Down. Two indicator lights inside the elevator display its current location, where a Red light represents the ground floor and a Green light represents the first floor. At each time interval, the control system reads the current floor and the input command, then moves the elevator and updates the indicator lights accordingly.

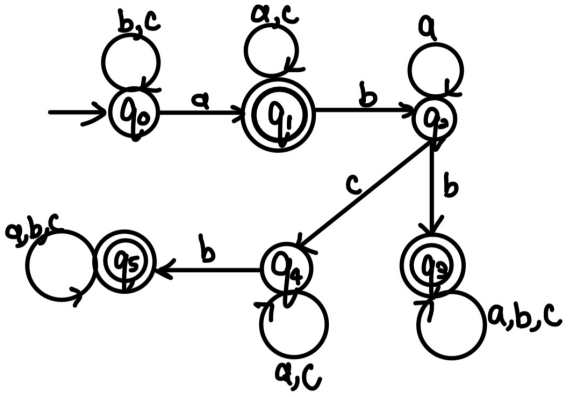
a. Construct the state transition table by using given information. (5 marks)
b. Draw the state transition diagram for this elevator mechanism. (5 marks)

Question 1

a)

fs	a	b	c
q_0	q_1	q_0	q_0
q_1	q_1	q_2	q_1
q_2	q_2	q_3	q_4
q_3	q_3	q_3	q_3
q_4	q_4	q_5	q_4
q_5	q_5	q_5	q_5

b)



q_3

c) Yes

Question 2

q_0 detect / at beginning of comment

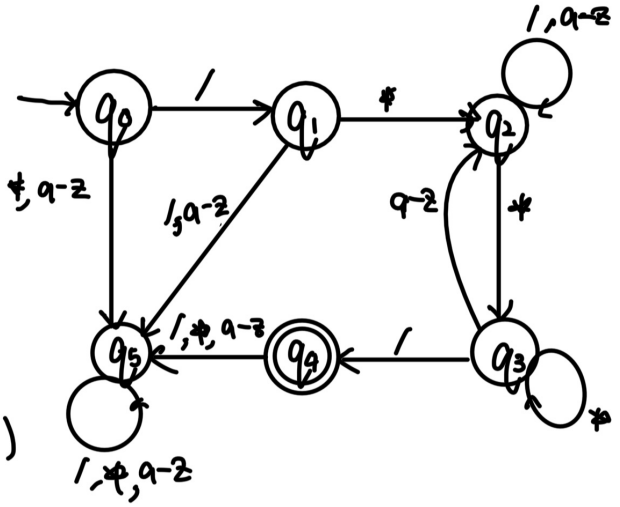
q_1 detect *

q_2 After /*, inside the comment

q_3 Found * and check the next input

q_4 detect /

q_5 Dead loop



$L = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{/, *, a-z\}, q_0, fs, \{q_4\})$

fs	/	*	a-z
q_0	q_1	q_5	q_5
q_1	q_5	q_2	q_5
q_2	q_2	q_3	q_2
q_3	q_4	q_3	q_2
q_4	q_5	q_5	q_5
q_5	q_5	q_5	q_5

Question 3

	f_s		f_o	
	0	1	0	1
S_0	S_1	S_3	1	0
S_1	S_1	S_2	1	1
S_2	S_3	S_4	0	0
S_3	S_1	S_0	0	0
S_4	S_3	S_4	0	0

001000

Question 4

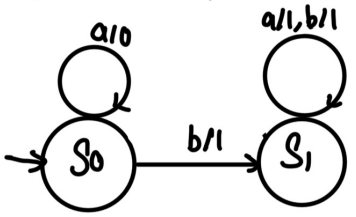
S_0 no b

S_1 at least 1 b

0 not accept

1 accept

	f_s		f_o	
	a	b	a	b
S_0	S_0	S_1	0	1
S_1	S_1	S_1	1	1



Question 5

S_0 ground floor

S_1 1st floor

9.

Input	Current state	Next state	output
Up	S_0	S_1	Green
Down	S_0	S_0	Red
Up	S_1	S_1	Green
Down	S_1	S_0	Red

	f_s		f_o	
	Up	Down	Up	Down
S_0	S_1	S_0	Green	Red
S_1	S_1	S_0	Green	Red

b.