UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF

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SEMESTER I

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SECI 1013 – DISCRETE STRUCTURE SECTION-08

ASSIGNMENT 5

NAMA	NO MATRIK
KHAIRUL IZZAT BIN HASHIM	**A20EC0058**
AIMAN NA'IM BIN ARIFFIN	**A20EC0008**
BRENDAN DYLAN GAMPA ANAK JOSEPH DUSIT	**A20EC0021**

LECTURER: DR NUR AZIZAH ALI

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SECI1013: DISCRETE STRUCTURE
2020/2021 – Sem. 1

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QUESTION 1

Let M = {S, I, q_0, f_s, F) be the DFA such that S = {q_0, q_1, q_2, q_3}, I={a,b}, F={q_1}, q_0=initial state and f_s is given by:

$f_s(q_0, a) = q_1$, $\quad f_s(q_0, b) = q_2$

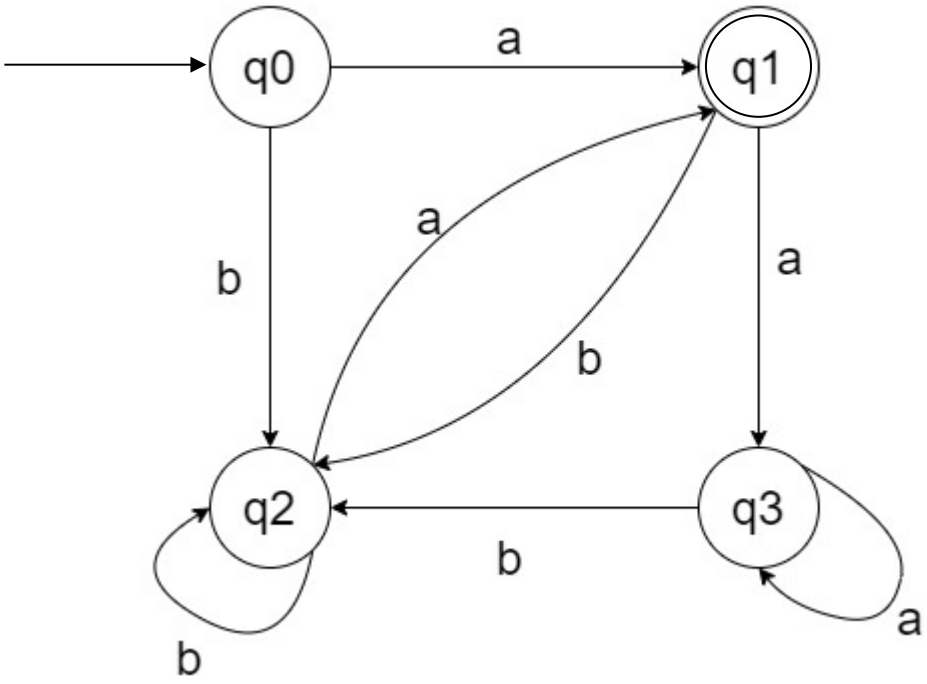
$f_s(q_1, a) = q_3$, $\quad f_s(q_1, b) = q_2$

$f_s(q_2, a) = q_1$, $\quad f_s(q_2, b) = q_2$

$f_s(q_3, a) = q_3$, $\quad f_s(q_3, b) = q_2$

i. Construct a state transition diagram of the DFA given the state transition function, f_s.

ANSWER



ii. DFA can be applied for verification of email password. Justify why DFA is suitable for verification?

- DFA can be applied to verify the password of an email.
- DFA can be used to first match the email and after that the password can be matched using the DFA with the password stored for an email address.
- Beside this DFA can help to determine whether a password is invalid or not like there should be one integer at least and one alphabet, there cannot be any special character as it would lead to a dead state. Minimum length password DFA could be built in order to accept a password with minimum length and all specification.

QUESTION 2

Given a deterministic finite automaton (DFA) as in Figure 1.

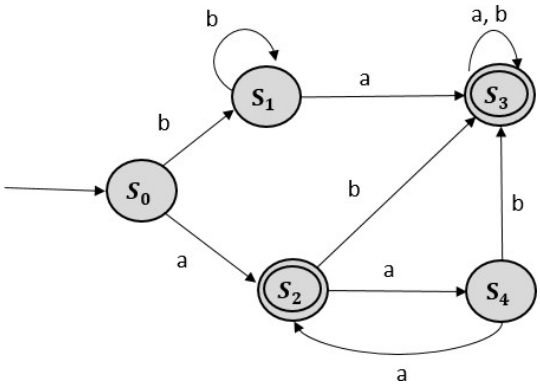


Figure 1

i. Construct a state transition table for state transition diagram.

ii. Identify whether the following input can be accepted by the DFA.

a) w = **aaaaaa**

b) w = **ababab**

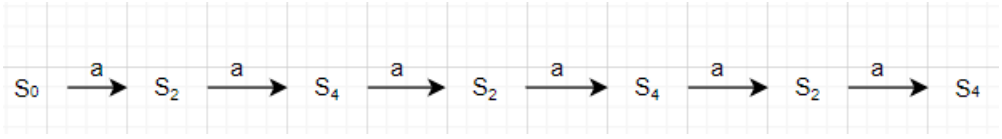
Show the configuration of the state transition in each question.

ANSWER

i. Transition table

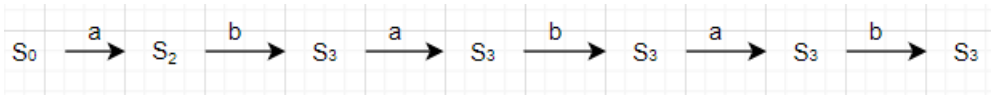
f_s	a	b
S_0	S_2	S_1
S_1	S_3	S_1
S_2	S_4	S_3
S_3	S_3	S_3
S_4	S_2	S_3

ii. a.) w = **aaaaaa**



$\therefore not\ accepted (the\ S_4\ is\ not\ the\ final\ state)$

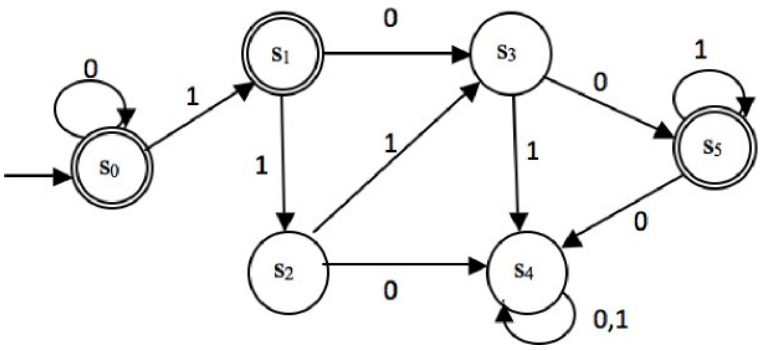
b.) w = **ababab**



$\therefore accepted (the\ S_3\ is\ the\ final\ state)$

QUESTION 3

i. Given a Deterministic Finite Automata (DFA) as in Figure 2.



a) List all the components of *S*, *I*, q_o, *F*.

ANSWER
S = $S_0, S_1, S_2, S_3, S_4, S_5$
I = 1,0
$qo = S_0$
F = S_0, S_1, S_5

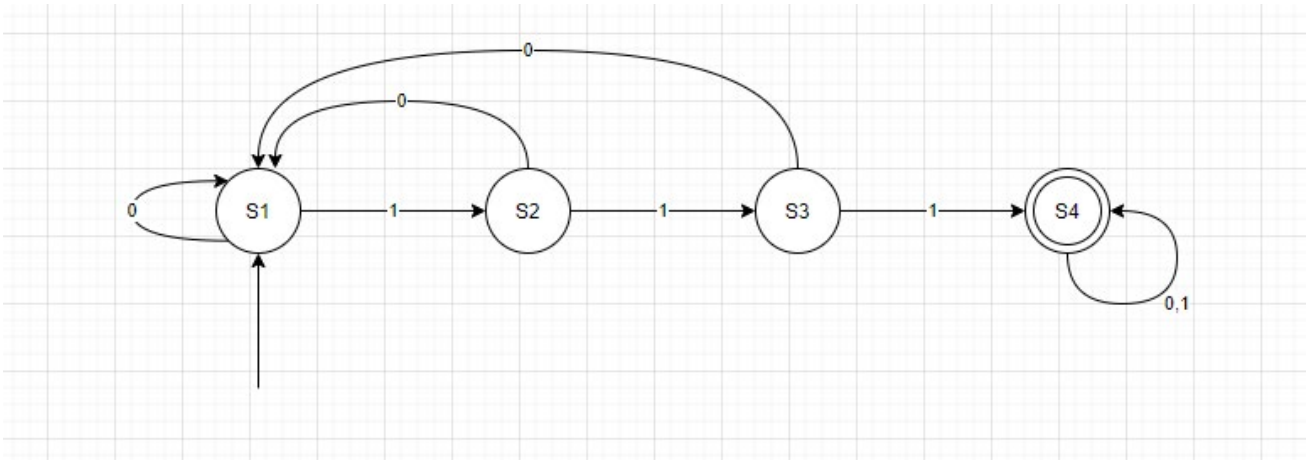
b) Find the sequence of configurations and state if the string **0011101100** is accepted by the DFA.

ANSWER

$$S_0 \xrightarrow{0} S_0 \xrightarrow{0} S_0 \xrightarrow{1} S_1 \xrightarrow{1} S_2 \xrightarrow{1} S_3 \xrightarrow{0} S_5 \xrightarrow{1} S_5 \xrightarrow{1} S_5 \xrightarrow{0} S_4 \xrightarrow{0} S_4$$

ii. Construct a DFA that accepts the set of all bit strings that contain three consecutive 1s.

ANSWER



QUESTION 4

You are going to develop a simple shooting game. There is one hero in a battle field with few enemies and other characters. There are three states in the game which are *WANDER*, *EVADE* and *ATTACK*. When the hero is wandering the field and suddenly encounters enemies while he is not in vulnerable situation, he will go into *ATTACK* stage by shooting the enemies. However, if while wandering the field and the hero suddenly encounters enemies and he is in vulnerable situation, he will shoot the enemies and goes into *EVADE* stage. While in *ATTACK* stage, if the hero encounters enemies and he is not vulnerable, he will remain in that stage and continues shooting. But if he encounters enemies and he is vulnerable, he will shoot and goes into *EVADE* stage. While in *EVADE* stage, if the hero encounters enemies and he is not vulnerable, he will go into *ATTACK* stage and shoots. But if he encounters enemies and he is vulnerable, he will remain in that stage and continues shooting. When the hero encounters characters that are not his enemies, he will not shoot. If he is in the *WANDER* stage at that time, he will continue wandering the field. If he is in *ATTACK* or *EVADE* stages, he will switch into *WANDER* stage. The inputs and outputs are given in the Table 1 below. **Construct a finite state diagram to model the game**.

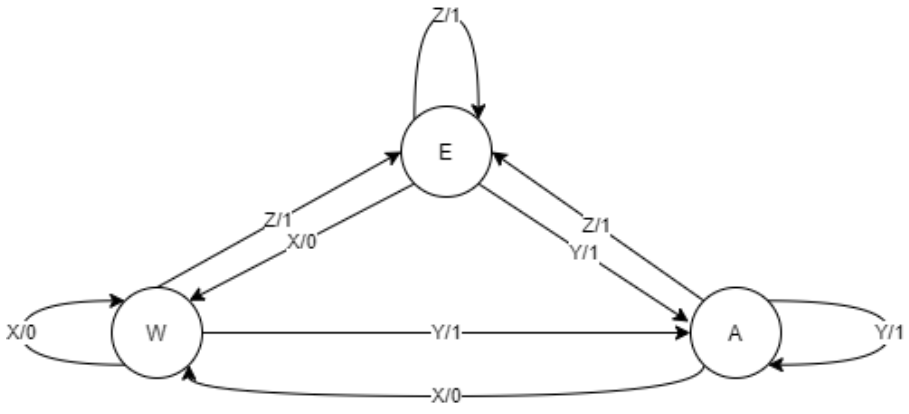
Input	Output
not enemies	shoot
enemies & not vulnerable	not shoot
enemies & vulnerable	

W = Wander
E = Evade
A = Attack

X = not enemies
Y = enemies & not vulnerable
Z = enemies & vulnerable

OUTPUT,
Shoot = 1
Not Shoot = 0

Fs	INPUT			OUTPUT		
	X	Y	Z	X	Y	Z
W	W	A	E	0	1	1
E	W	A	E	0	1	1
A	W	A	E	0	1	1



QUESTION 5

ATM is a computerized machine that provides bank customers to gain access to their accounts using magnetic encoded plastic card and code number. It enables the customer to perform online transactions without involving cashier, clerk and bank teller. The customer makes cash withdrawal, check account balances, transfer money as well as purchase prepaid mobile phone credit by using ATM card. Typical PIN based ATM has following processes:

- Insert ATM card to establish interface. The card will be validated to ensure the correct ATM card is inserted. If the card is unsuccessfully validated, the card is ejected and ATM session is terminated.
- For valid ATM card, user is asked to enter the PIN and press the execution key for the system to match the PIN, if PIN does not match, then user access is denied to the next stage and he or she is requested to repeat the operation with the correct PIN for a fixed two retries.
- If after the third time the PIN is unmatched, the card will be locked and ATM session is terminated.
- If the PIN matches then the transaction interface is displayed and user has to select the transaction that they wish to perform.
- After the machine performs the chosen transaction, it will prompt user if a new transaction is to be performed. If the response is 'Yes', the transaction interface is again displayed and if 'No' the transaction is terminated and card ejected and ATM session is terminated.

Based on the above description, the states, inputs and outputs are as follow:

States:

S_1: Welcome screen

S_2: Validating card

S_3: 1st PIN entering screen

S_4: 2nd PIN entering screen

S_5: 3rd PIN entering screen

S_6: Choosing transaction screen

S_7: Performing transaction

S_8: Asking for other transaction screen

S_9: Terminate ATM session

Inputs:

A: Insert ATM card

B: Valid ATM card

C: Invalid ATM card

D: Correct PIN

E: Incorrect PIN

F: Transaction is selected

G: Complete transaction

H: Yes for other transaction

I: No for other transaction screen

Outputs:

0: Nothing happened

1: Eject ATM card

2: Lock ATM card

Draw the transition diagram for the above system.

ANSWER

Fs	**input**									**output**								
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
S_1	**S_2**									**0**								
S_2		**S_3**	**S_9**								**0**	**1**						
S_3				**S_6**	**S_4**								**0**	**0**				
S_4				**S_6**	**S_5**								**0**	**0**				
S_5				**S_6**	**S_9**								**0**	**2**				
S_6						**S_7**									**0**			
S_7							**S_8**									**0**		
S_8								**S_6**	**S_9**								**0**	**1**
S_9