UTM

UNIVERSITI TEKNOLOGI MALAYSIA

ASSIGNMENT 5

COURSE NAME: DISCRETE STRUCTURE
COURSE CODE: SECI 1013
SECTION: 03
LECTURER'S NAME: Dr. Nor Azizah Ali
GROUP NUMBER: 7

GROUP MEMBERS:

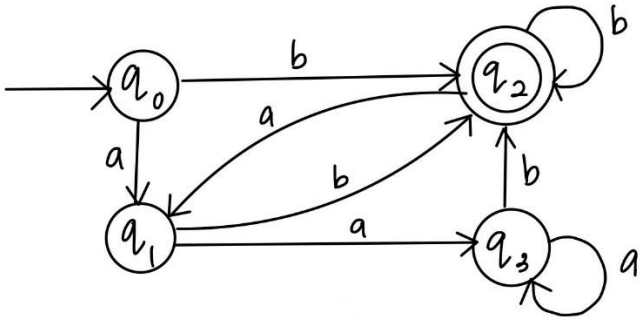
Name	Matric No.
LUQMAN ARIFF BIN NOOR AZHAR	A20EC0202
TERENCE A/L LOORTHANATHAN	A20EC0165
MADINA SURAYA BINTI ZHARIN	A20EC0203

QUESTION 1

Let M = {S, I, q0, fs, F) be the DFA such that S = {q0, q1, q2, q3}, I = {a, b}, F={q1}, q0=initial state and fs is given by:

fs (q0, a) = q1, fs (q0, b) = q2
fs (q1, a) = q3, fs (q1, b) = q2
fs (q2, a) = q1, fs (q2, b) = q2
fs (q3, a) = q3, fs (q3, b) = q2

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



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

DFA can be used to match email and the password. Besides, it also can help to decide whether the password is invalid or not. For instance, it should have at least one integer and one alphabet. Minimum length of password also could be built using DFA to accept a password with minimum length and all specifications.

QUESTION 2

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

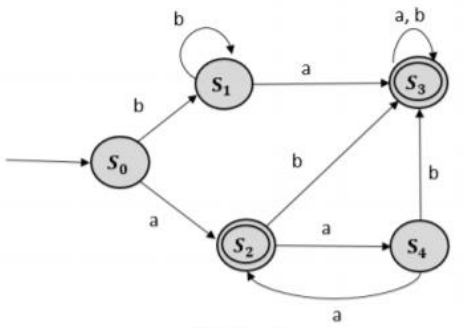


Figure 1

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

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

a) w = aaaaaa

a a a a a a

$S_0 \rightarrow S_2 \rightarrow S_4 \rightarrow S_2 \rightarrow S_4 \rightarrow S_2 \rightarrow S_4$

Not accepted

b) w = abababb

a b a b a b

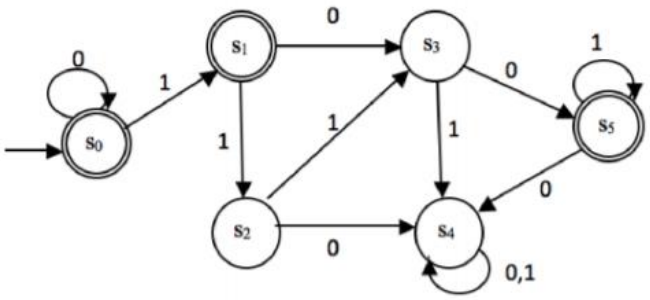
$S_0 \rightarrow S_2 \rightarrow S_3 \rightarrow S_3 \rightarrow S_3 \rightarrow S_3 \rightarrow S_3$

Accepted

Show the configuration of the state transition in each question.

QUESTION 3

i. Given a deterministic finite automaton (DFA) as in Figure 2.



a) List all the components of S, I, q0, F.

S = {S_0, S_1, S_2, S_3, S_4, S_5}
I = {a, b}
q_0 = {S_0}
F = {S_0, S_1, S_5}

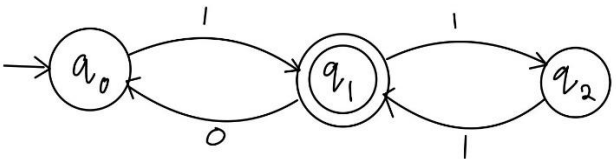
b) Find the sequence of configurations and state if the string **0011101100** is accepted by the DFA.

f_s (S_0, 0) = S_0, **f_s (S_0, 0) = S_1**
f_s (S_1, 0) = S_3, **f_s (S_1, 0) = S_2**
f_s (S_2, 0) = S_4, **f_s (S_2, 0) = S_3**
f_s (S_3, 0) = S_5, **f_s (S_3, 0) = S_4**
f_s (S_4, 0) = S_4, **f_s (S_4, 0) = S_4**
f_s (S_5, 0) = S_4, **f_s (S_5, 0) = S_5**

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

(***Not Accepted***)

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



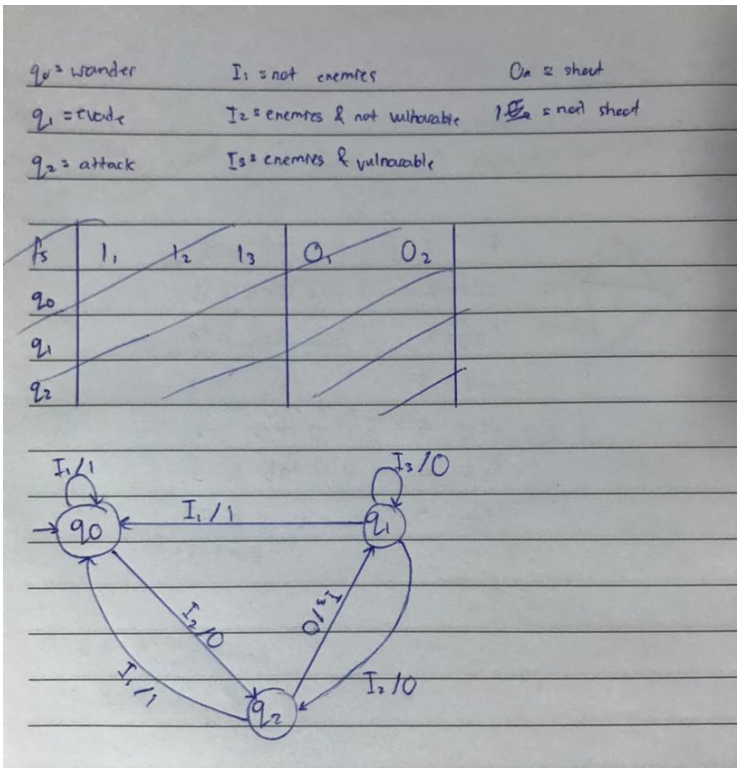
$$q_o \xrightarrow{1} q_1 \xrightarrow{1} q_2 \xrightarrow{1} q_1$$

QUESTION 4

You are going to develop a simple shooting game. There is one hero in a battlefield 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.**

Table 1

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



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:

S1: Welcome screen
S2: Validating card
S3: 1st PIN entering screen
S4: 2nd PIN entering screen
S5: 3rd PIN entering screen.
S6: Choosing transaction screen.
S7: Performing transaction
S8: Asking for other transaction screen.
S9: Terminate ATM session

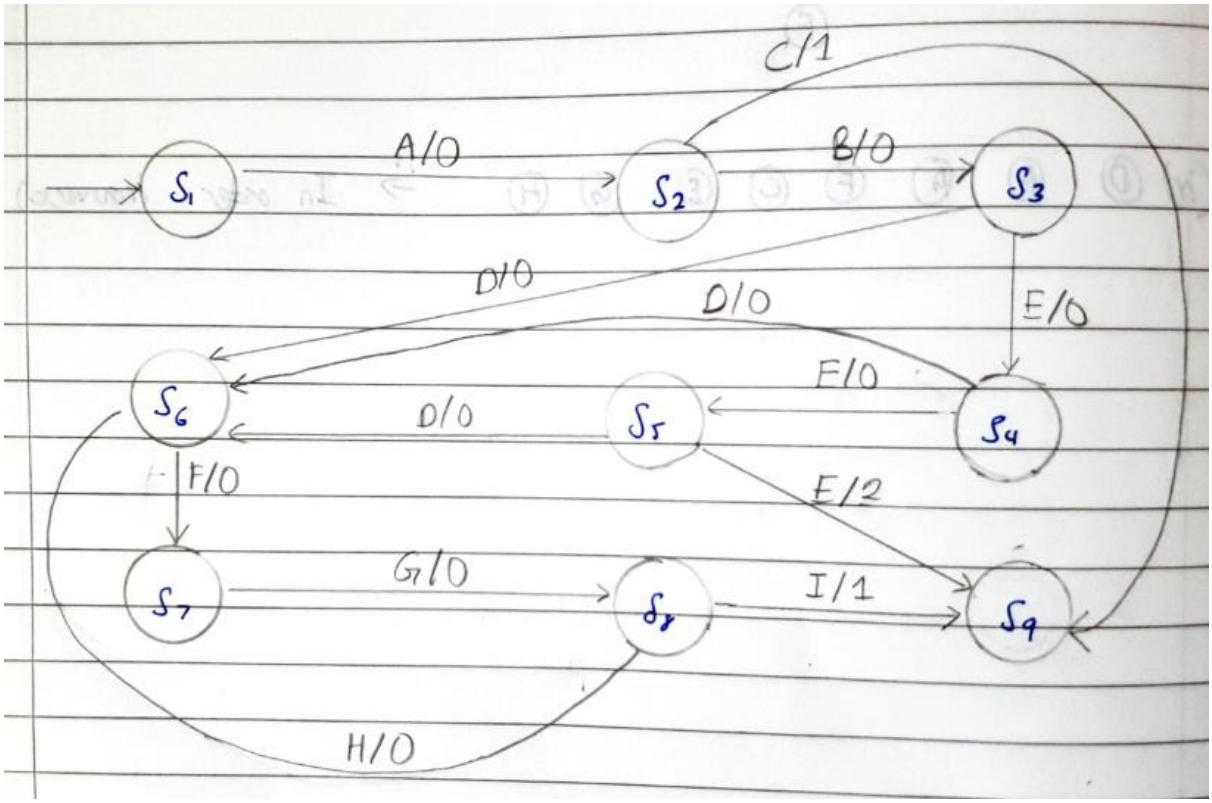
Inputs:

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.


C/1
A/0
B/0
S1
S2
S3
D/0
D/0
E/0
F/0
S6
D/0
S5
S4
F/0
E/2
G/0
I/1
S7
S8
S9
H/0