ASSIGNMENT 5
SECI1013: DISCRETE STRUCTURE
Group : 6
Group members:

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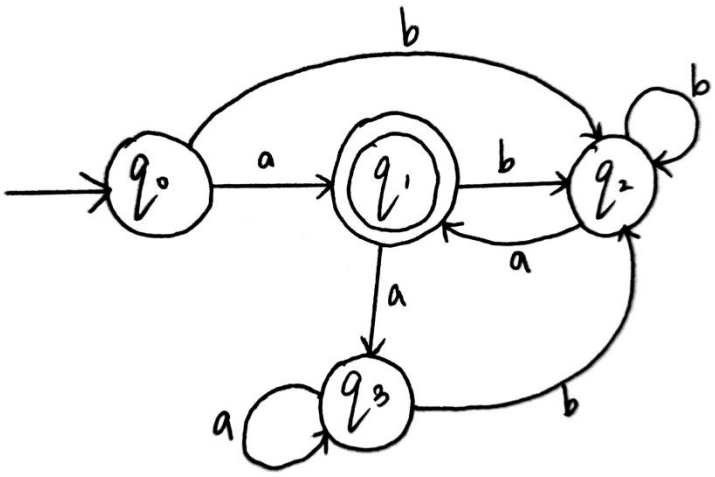
1. (i)

f_s	a	b
q_0	q_1	q_2
q_1	q_3	q_2
q_2	q_1	q_2
q_3	q_3	q_2

∴ State transition diagram:



(ii)

DFA can be applied to verify the password of an email. Password is a finite state.

DFA is used to first match the email. Then, DFA will match the password with the password registered using the email address. Furthermore, DFA can be used to determine the validity of password. For example there should be at least one capital letter, one small letter and one integer or user is not allowed to add any special character into the password. DFA can also help to determine the minimum length of password so that the password length is fixed.

2. (i)

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)

S_0 = initial state

F = {S_2 , S_3}

I = {a , b}

S = {S_0 , S_1 , S_2 , S_3 , S_4}

a) **w = aaaaaa**

$$S_0 \xrightarrow{a} S_2 \xrightarrow{a} S_4 \xrightarrow{a} S_2 \xrightarrow{a} S_4 \xrightarrow{a} S_2 \xrightarrow{a} S_4$$

Not accepted by DFA because $S_4 \notin F$

b) **w = ababab**

$$S_0 \xrightarrow{a} S_2 \xrightarrow{b} S_3 \xrightarrow{a} S_3 \xrightarrow{b} S_3 \xrightarrow{a} S_3 \xrightarrow{b} S_3$$

Accepted by DFA because $S_3 \in F$

3. (i)

a) $S = \{S_0, S_1, S_2, S_3, S_4, S_5\}$

$I = 0, 1$

$q_0 = \{S_0\}$

$F = \{S_0, S_1, S_5\}$

b) **0011101100**

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

Not accepted by DFA because $S_4 \notin F$

(ii) **Construct a DFA that accepts all of bit strings that contain 3 consecutive 1s.**

$S = \{S_0, S_1, S_2, S_3\}$ (need 4 states)

$I = 0, 1$

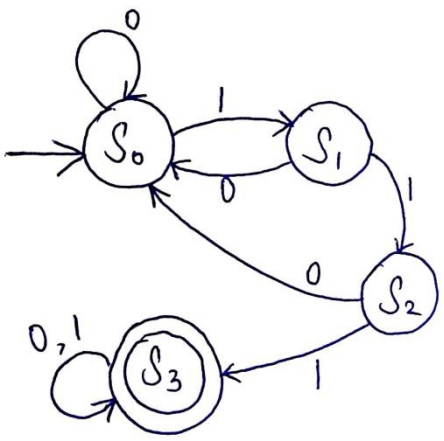
$q_0 = \{S_0\}$

$F = \{S_3\}$

$f_s =$

f_s	0	1
S_0	S_0	S_1
S_1	S_0	S_2
S_2	S_0	S_3
S_3	S_3	S_3

State diagram:



4. M = {S , I , O, q_0 , f_s , f_0}

W = WANDER , E = EVADE , A = ATTACK

S = {W , E , A}

n = not enemies , env = enemies, not vulnerable , ev = enemies, vulnerable

I = {n , env , ev}

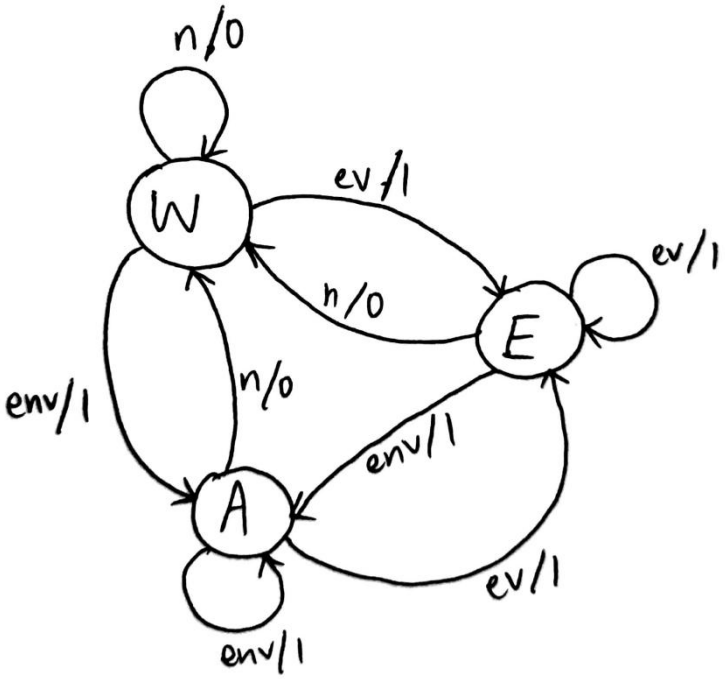
0 = not shoot , 1 = shoot

O = {0 , 1}

Transition table :

State	Input, f_s			Output, f_o		
	n	**env**	**ev**	**n**	**env**	**ev**
W	W	A	E	0	1	1
E	W	A	E	0	1	1
A	W	A	E	0	1	1

Finite state diagram:



5. M = {S , I , O, q_0 , f_s , f_0}

Transition table:

State	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Transition diagram: