Tutorial problem

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Problem

1. Minimize the following DFA using table filling algorithm where A is the start state. The states C, F and I are the final states.

δ	0	1
A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
F	G	B
G	H	B
H	I	C
*I	A	E

Table filling algorithm

B								
*C	X	X						
D			X					
E			X					
*F	X	X		X	X			
G			X			X		
H			X			X		
*I	X	X		X	X		X	X
	A	B	*C	D	E	*F	G	H

Step 1: Cross the combinations of Final and non-final states.
(A,C) (A,F) (A,I) (B,C) (B,F) (B,I) (C,H) (C,G) (C,D) (C,E), (D,I) (D,F) (E,I) (E,F) (F,G) (F,H) (G,I) (H,I) cannot be equivalent states.

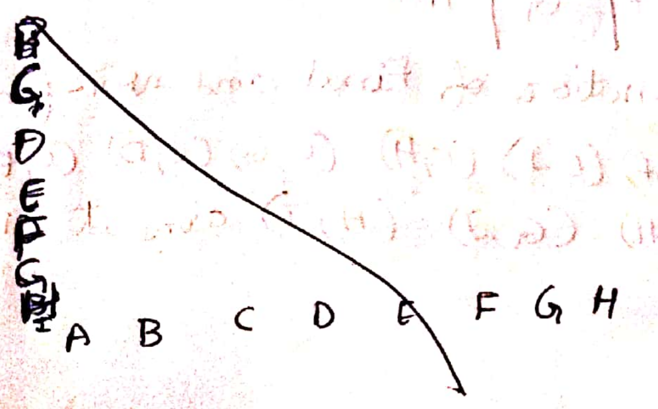
Boxes where combinations of final & final, non-final and non-final are left open.

Step 2 :

Check the 0 i/p and 1 i/p combinations of A and B to start with.

δ	0	1
× (A,B)	(B,C)	(E,F)
(A,D)	(B,E)	(E,H)
× (A,E)	(B,F)	(E,I)
(A,G)	(B,H)	(E,B)
× (A,H)	(B,I)	(E,C)
(B,H)	(C,I)	(F,C)
× (B,G)	(C,H)	(F,B)
× (B,D)	(C,E)	(F,H)
(B,E)	(C,F)	(F,I)
(C,F)	(D,G)	(H,B)
(C,I)	(D,A)	(H,E)
× (D,H)	(E,I)	(H,C)
(D,G)	(E,H)	(H,B)
× (E,G)	(F,H)	(I,B)
(E,H)	(F,I)	(I,C)
(F,I)	(G,A)	(B,F)
× (G,H)	(H,I)	(B,C)

Table



	A	B	C	D	E	F	G	H
B	×							
C	×	×						
D		×	×					
E	×		×					
F	×	×		×	×			
G		×	×		×	×		
H	×		×	×		×		
I	×	×		×	×		×	×

Hence the remaining pairs are equivalent

δ	0	1
(A,D)	(B,E)	(E,H)
(A,G)	(B,H)	(E,B)
(B,H)	(C,I)	(F,C)
(B,E)	(C,F)	(F,I)
* (C,F)	(D,G)	(H,B)
* (C,I)	(D,A)	(H,E)
(D,G)	(E,H)	(H,B)
(E,H)	(F,I)	(I,C)
(F,I)	(G,A)	(B,E)

From the above table

A = D & D = G & A = G

A = D = G

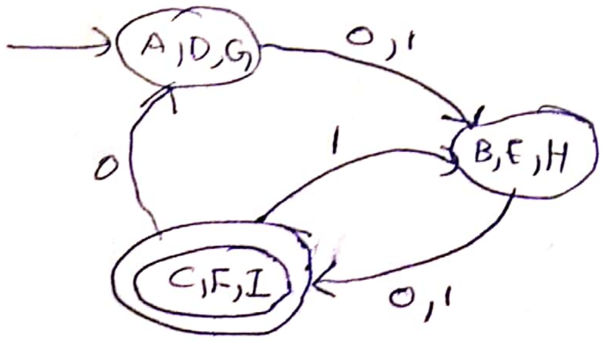
B = E & E = H & B = H

B = E = H

⇒ C = I = F

δ	0	1
⇒ (A,D,G)	(B,E,H)	(B,E,H)
(B,E,H)	(C,F,I)	(C,F,I)
(C,F,I)	(A,D,G)	(E,B,H)

Transition diagram of minimised DFA



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Problem 2:
Consider the DFA given by the transition

δ	0	1
$\rightarrow q_1$	q_2	q_3
q_2	q_3	q_5
$*q_3$	q_4	q_3
q_4	q_3	q_5
$*q_5$	q_2	q_5

(a) Draw the table of distinguishabilities for this automation.

(b) Construct the minimum state equivalent DFA.

Table filling algorithm,

q_2				
$*q_3$	X	X		
q_4			X	
$*q_5$	X	X		X
	q_1	q_2	$*q_3$	q_4

Step 1: Cross the combinations of Final and non-final states
(q_1, q_5) (q_1, q_3) (q_2, q_5) (q_2, q_3) (q_3, q_4) (q_4, q_5) cannot be equivalent states

Boxes where combinations of final & final, non-final and non-final are left open.

Step 2:

Check the o/p and i/p combinations of A and B to start with.

δ	0	1
× (q_1, q_2)	(q_2, q_3)	(q_3, q_5)
× (q_1, q_4)	(q_2, q_3)	(q_3, q_5)
(q_2, q_4)	(q_3, q_3)	(q_5, q_5)
(q_3, q_5)	(q_4, q_2)	(q_3, q_5)

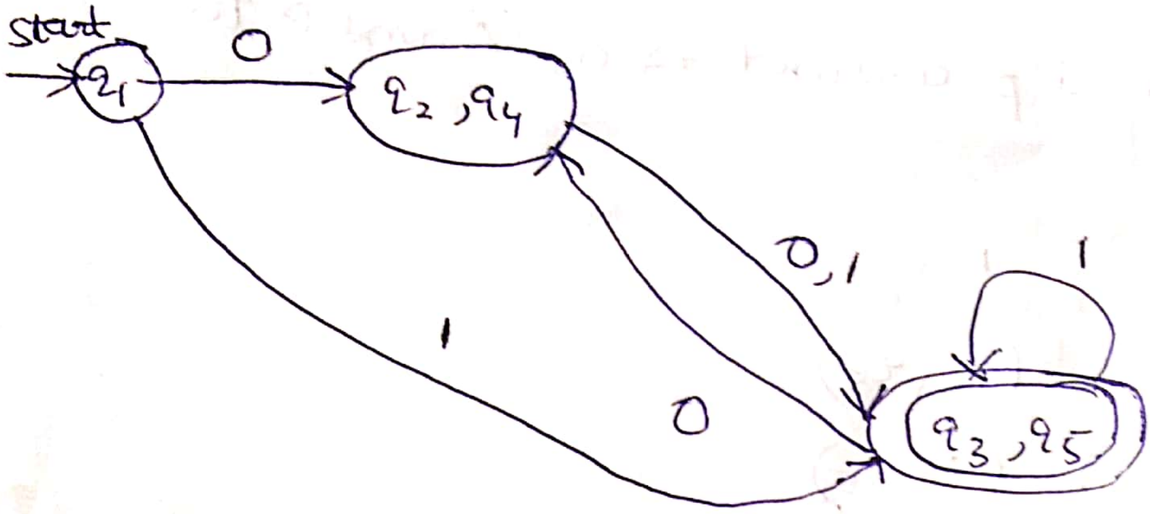
q_2	×			
* q_3	×	×		
q_4	×		×	
* q_5	×	×		×
	q_1	q_2	* q_3	q_4

Step 3:

Therefore only (q_2, q_4) and (q_3, q_5) form the equivalents for the given transition.

δ	0	1
→ (q_2, q_4)	(q_3, q_5)	(q_5, q_5)
* (q_3, q_5)	(q_4, q_2)	(q_3, q_5)

Reduced DFA



Problem 3

Repeat exercise 4.4.1 for the DFA

δ	0	1
$\rightarrow q_1$	q_2	q_6
q_2	q_1	q_3
$*q_3$	q_2	q_4
q_4	q_4	q_2
q_5	q_4	q_5
$*q_6$	q_5	q_4

Table filling algorithm

q_2	X				
$*q_3$	X	X			
q_4	X	X	X		
q_5	X	X	X	X	
$*q_6$	X	X	X	X	X
	q_1	q_2	$*q_3$	q_4	q_5

Step 1: Cross the combinations of Final and non-final states.

(q_1,q_3) (q_1,q_6) ~~(q_1,q_5)~~ (q_2,q_3) (q_2,q_6) (q_3,q_4) (q_3,q_5)

(q_4,q_6) (q_5,q_6) cannot be equivalents.

Step 2:

δ	0	1	
(q_1,q_2)	(q_2,q_1)	(q_6,q_3)	X
(q_1,q_4)	(q_2,q_4)	(q_6,q_2)	X
(q_1,q_5)	(q_2,q_4)	(q_6,q_5)	X
(q_2,q_4)	(q_1,q_4)	(q_3,q_2)	X
(q_2,q_5)	(q_1,q_4)	(q_3,q_5)	X
(q_3,q_6)	(q_2,q_5)	(q_4,q_4)	X
(q_4,q_5)	(q_4,q_4)	(q_2,q_5)	X

After step 2 and step 3 we can say there are no equivalent states for the given table