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CSE211 – Formal Languages and Automata Theory

U1L21 –Minimization of Automata

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Agenda

- Recap of previous class
- Minimization of Automata
- Myhill Nerode Theorem
- Problems on minimization of DFA

Myhill Nerode Theorem

- Testing Equivalence of States
  - **Table-filling algorithm(**Myhill Nerode Theorem)

Basis.

If p is an accepting state and q is not, then the pair $\{p, q\}$ is distinguishable.

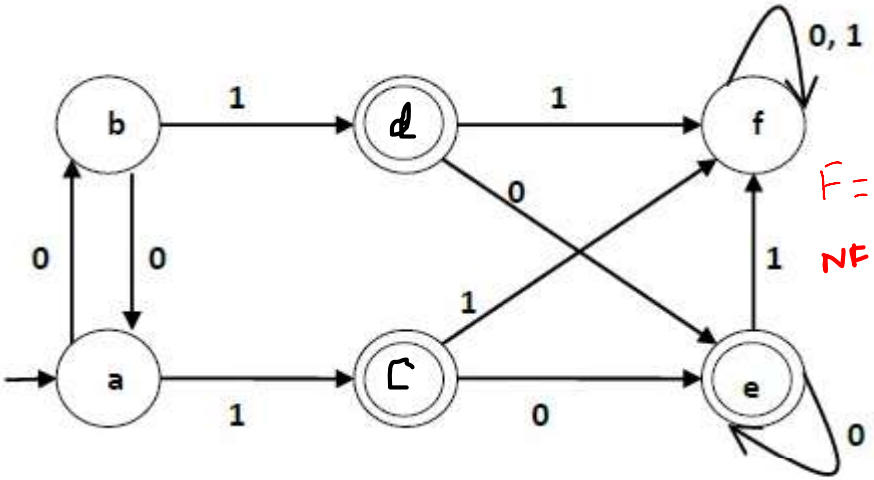
Induction.

- Let p and q be states such that for some input symbol a, the next states $r = \delta(p, a)$ and $s = \delta(q, a)$ are known to be distinguishable. Then $\{p, q\}$ are distinguishable.

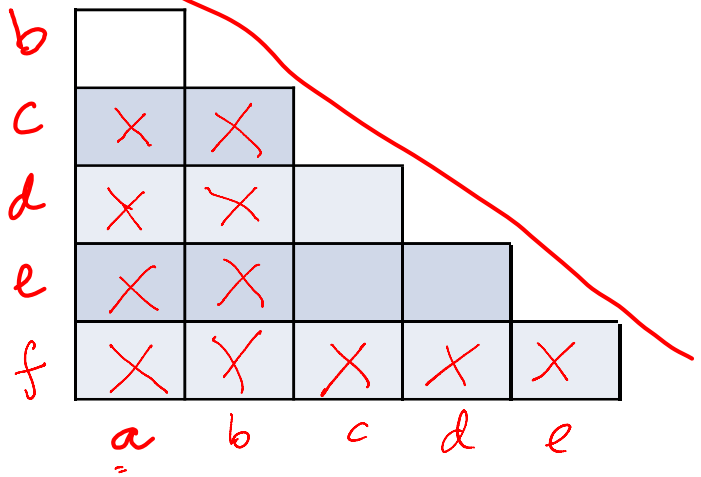
Myhill Nerode Algorithm

- Step1: Draw a table for all pairs of states (p,q)
- Step 2: Mark all pairs where p∈F and q∉F
- Step 3: If there are any unmarked pairs (p,q) such that [$\delta(p, a)$, $\delta(q, a)$] is marked, then mark [p,q] where a is an input symbol.
- Repeat this until no more markings can be done
- Step 4: Combine all the unmarked pairs and make them a single state in the minimized DFA

Equivalence States: Example

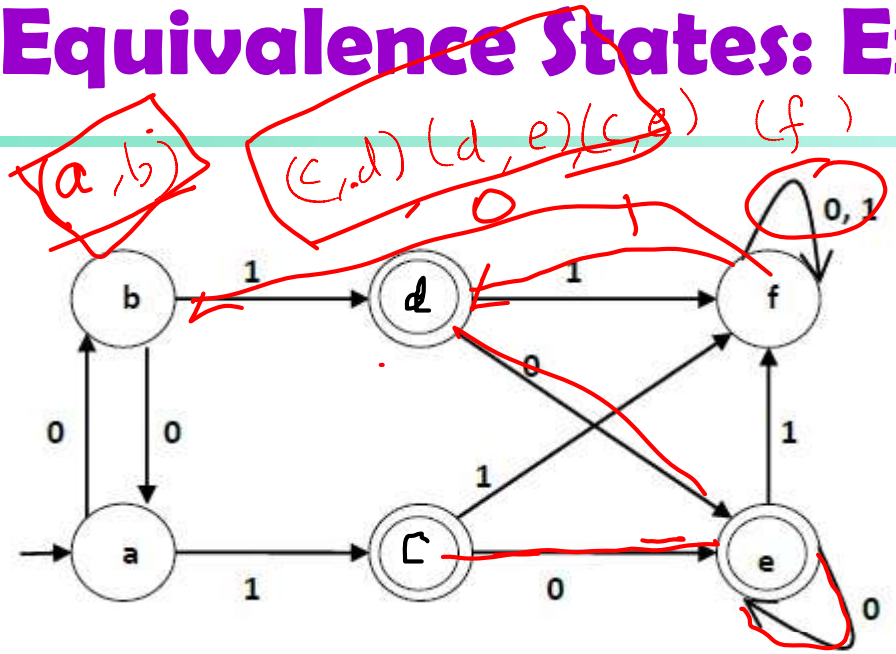


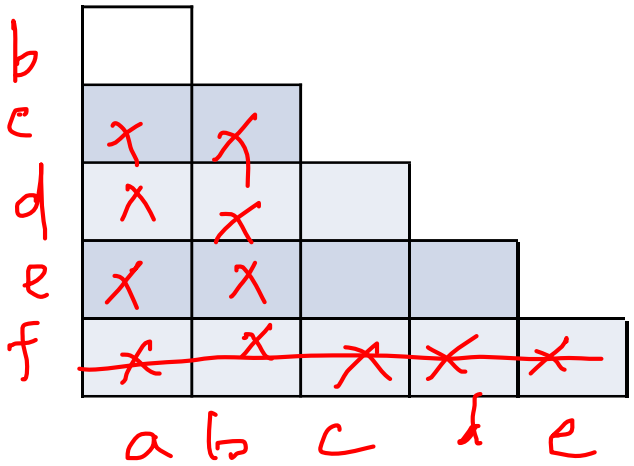
F = {c, d, e}
NF = {a, b, f}



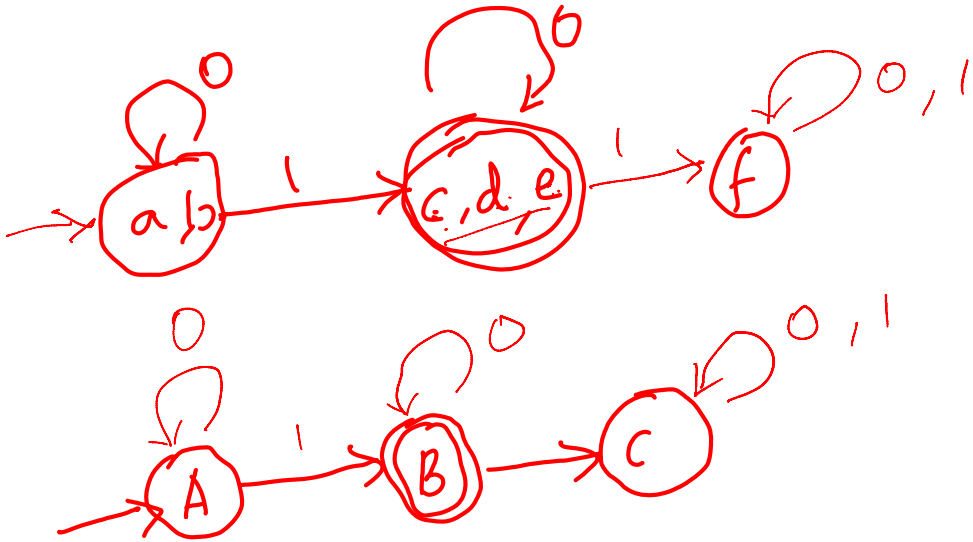
Unmarked Pair	Output Pair by x		Marked pair from O/P	Is to be Marked
	0	1		?
(a, b)	(b, a)	(c, d)	-	→ No
(a, f)	(b, f)	(c, f)	(c, f)	a, f is to be marked
(b, f)	(a, f)	(d, f)	(a, f) (d, f)	Yes
(c, e)	(e, e)	(f, f)	-	No

Equivalence States: Example

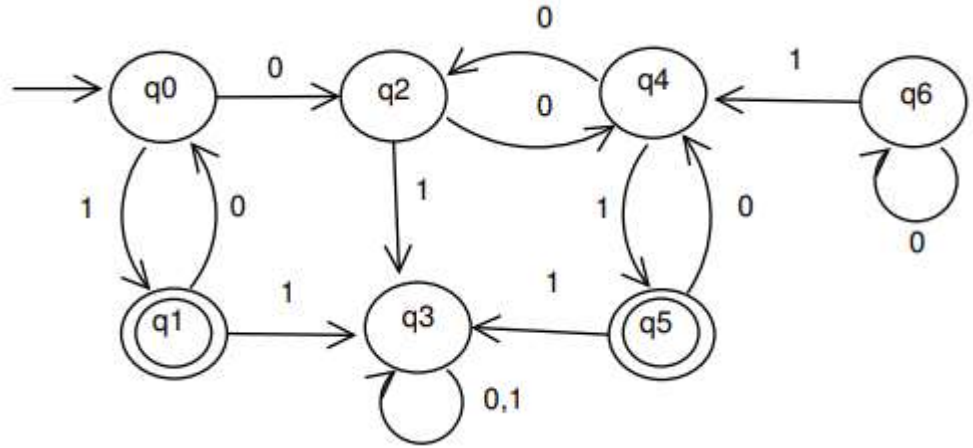




Unmarked Pair	Output Pair by x		Marked pair from O/P	Is to be Marked
	0	1		
(c,d)	(e,e)	(f,f)	-	No
(d,e)	(e,e)	(f,f)	-	No
(a,b)	(b,a)	(c,d)	-	No
(c,d)	(e,e)	(f,f)	-	No
(c,e)			-	No

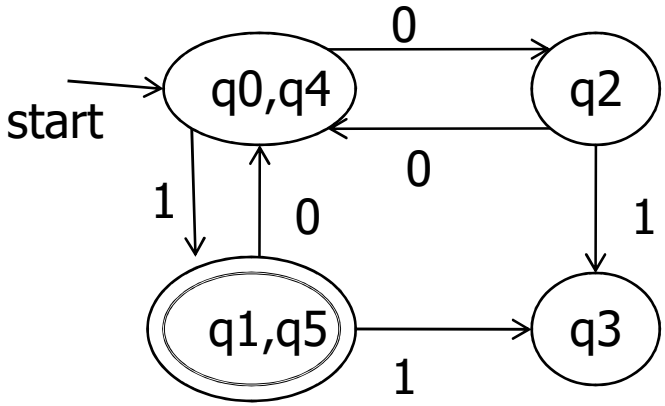

0
0
1
a, b
c, d, e
1
f
0, 1
0
0
1
A
B
C
0, 1

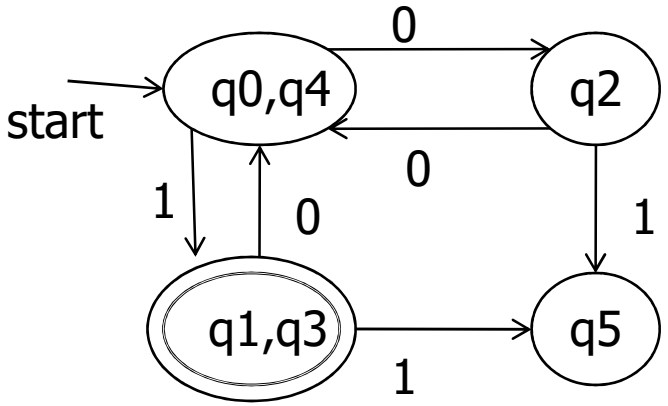
Example 2

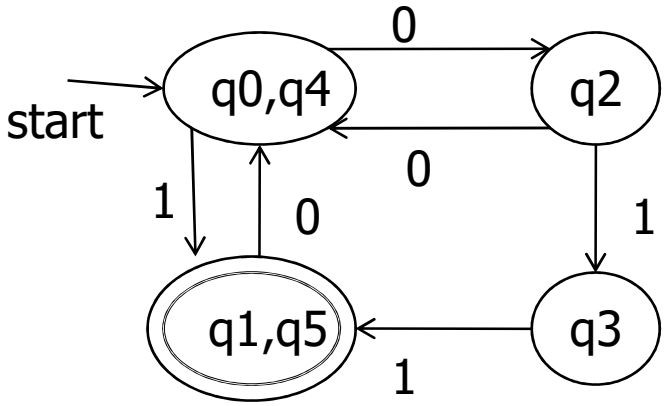


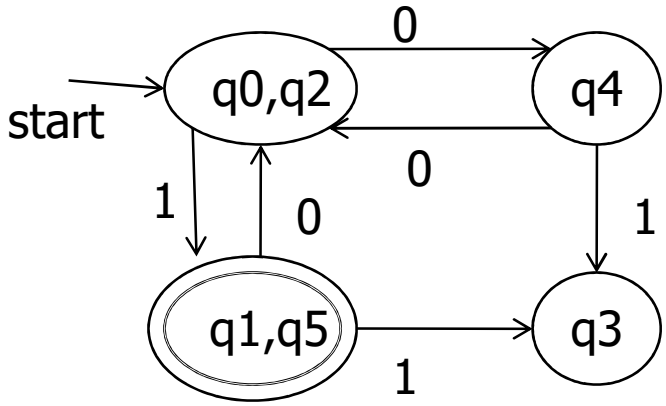
Example 2 Answers

Correct









References

- John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, *Introduction to Automata Theory*, Languages, and Computation, Pearson, 3rd Edition, 2011.
- Peter Linz, An Introduction to Formal Languages and Automata, Jones and Bartle Learning International, United Kingdom, 6th Edition, 2016.

Next Class:

Unit II

THANK YOU.