

# Digital Electronics and Computer Organization

## Digital Design

### Lecture 20: State Table Reduction



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

1/2020

Innovate

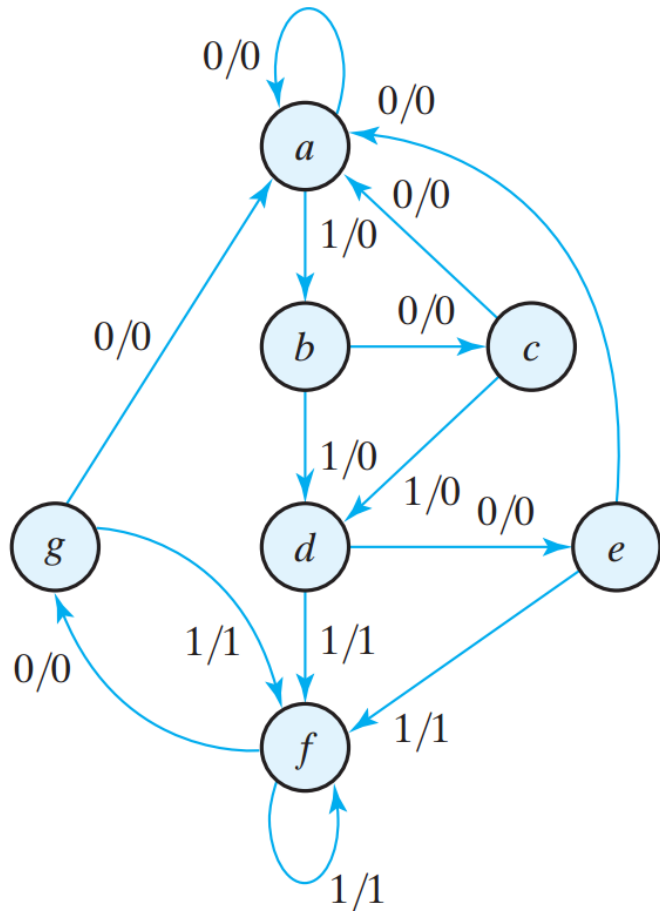
achieve

1

lead



# State Table Reduction



*State Table*

Present State	Next State		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
<i>a</i>	<i>a</i>	<i>b</i>	0	0
<i>b</i>	<i>c</i>	<i>d</i>	0	0
<i>c</i>	<i>a</i>	<i>d</i>	0	0
<i>d</i>	<i>e</i>	<i>f</i>	0	1
<i>e</i>	<i>a</i>	<i>f</i>	0	1
<i>f</i>	<i>e</i> ← <i>g</i>	<i>f</i>	0	1
<del><i>g</i></del>	<del><i>a</i></del>	<del><i>f</i></del>	<del>0</del>	<del>1</del>



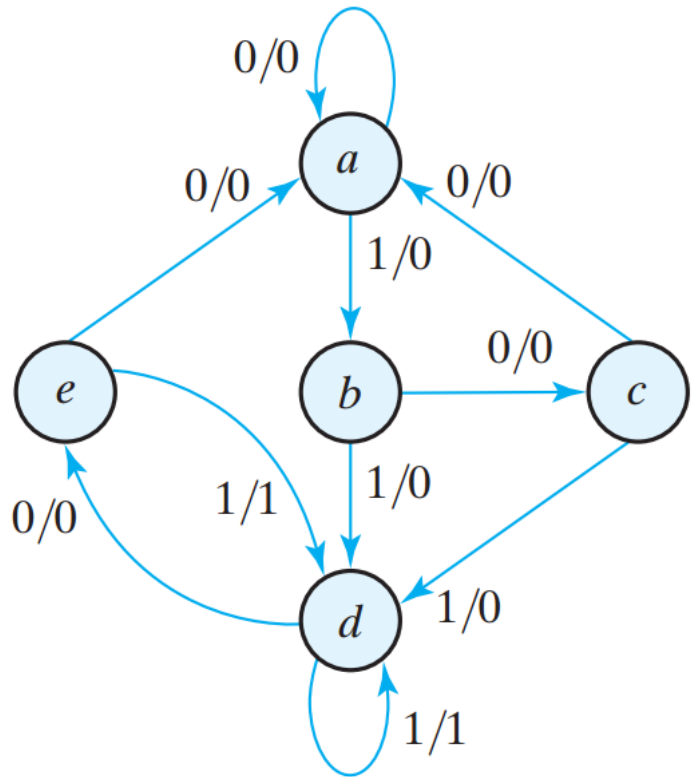
# State Table Reduction

## Reducing the State Table

Present State	Next State		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
$a$	$a$	$b$	0	0
$b$	$c$	$d$	0	0
$c$	$a$	$d$	0	0
$d$	$e$	$d \leftarrow f$	0	1
$e$	$a$	$d \leftarrow f$	0	1
<del><math>f</math></del>	<del><math>e</math></del>	<del><math>f</math></del>	<del>0</del>	<del>1</del>



# State Table Reduction



*Reduced State Table*

Present State	Next State		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
<i>a</i>	<i>a</i>	<i>b</i>	0	0
<i>b</i>	<i>c</i>	<i>d</i>	0	0
<i>c</i>	<i>a</i>	<i>d</i>	0	0
<i>d</i>	<i>e</i>	<i>d</i>	0	1
<i>e</i>	<i>a</i>	<i>d</i>	0	1



# State Table Reduction

## Reduced State Table

Present State	Next State		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
<i>a</i>	<i>a</i>	<i>b</i>	0	0
<i>b</i>	<i>c</i>	<i>d</i>	0	0
<i>c</i>	<i>a</i>	<i>d</i>	0	0
<i>d</i>	<i>e</i>	<i>d</i>	0	1
<i>e</i>	<i>a</i>	<i>d</i>	0	1

## Three Possible Binary State Assignments

State	Assignment 1, Binary	Assignment 2, Gray Code	Assignment 3, One-Hot
<i>a</i>	000	000	00001
<i>b</i>	001	001	00010
<i>c</i>	010	011	00100
<i>d</i>	011	010	01000
<i>e</i>	100	110	10000



# Implication Chart

Current State	Next State		Output ( $Z$ )	
	$A = 0$	$A = 1$	$A = 0$	$A = 1$
S0	S3	S2	1	1
S1	S0	S4	0	0
S2	S3	S0	1	1
S3	S1	S3	0	0
S4	S2	S1	0	0

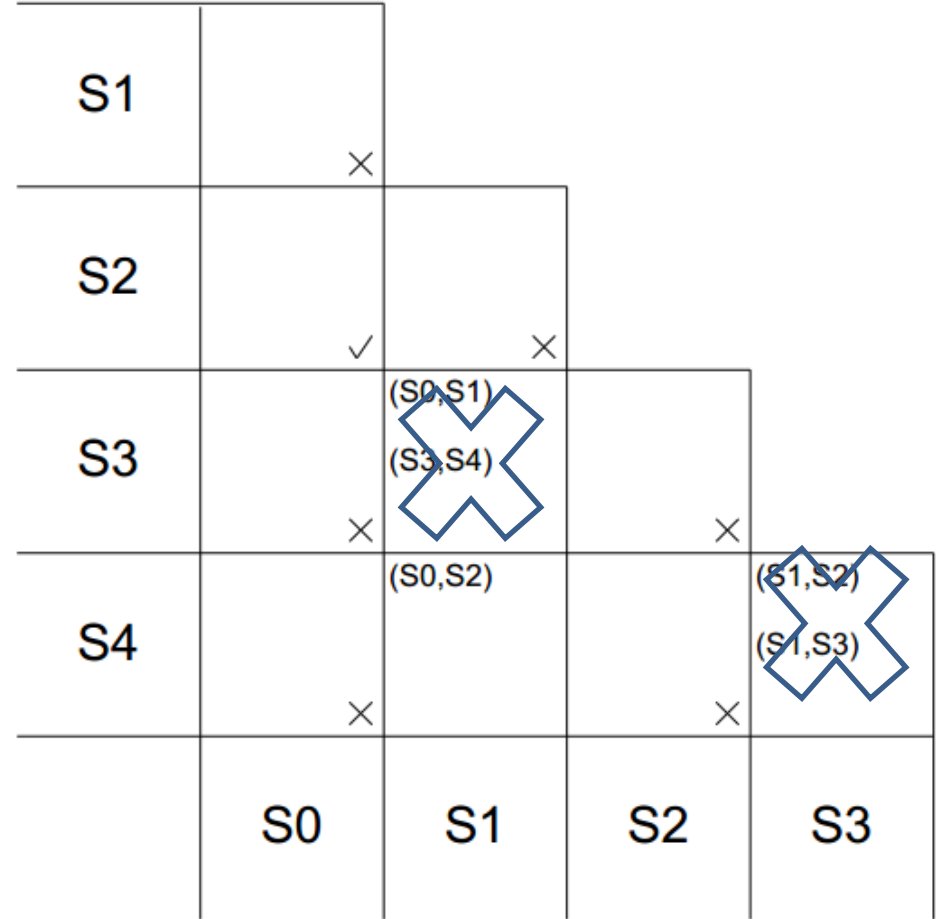
State table



# Implication Chart

Current State	Next State		Output ( $Z$ )	
	$A = 0$	$A = 1$	$A = 0$	$A = 1$
S0	S3	S2	1	1
S1	S0	S4	0	0
S2	S3	S0	1	1
S3	S1	S3	0	0
S4	S2	S1	0	0

State table



Implication chart



# Implication Chart

S1		x		
S2		✓	x	
S3		(S0,S1) (S2,S4)		x
S4		(S0,S2)		(S1,S2) (S1,S3)
	S0	S1	S2	S3

Implication chart

Current State	Next State		Output (Z)	
	A = 0	A = 1	A = 0	A = 1
S0	S3	S2	1	1
S1	S0	S4	0	0
S2	S3	S0	1	1
S3	S1	S3	0	0
S4	S2	S1	0	0

Current State	Next State		Output (Z)	
	A = 0	A = 1	A = 0	A = 1
S0	S3	S0	1	1
S1	S0	S1	0	0
S3	S1	S3	0	0